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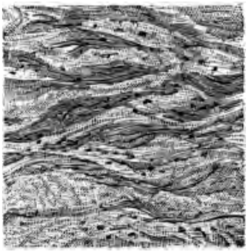

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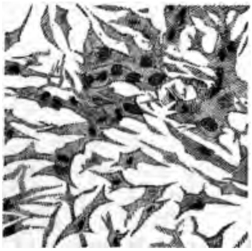

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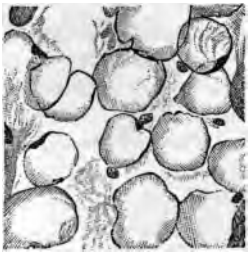

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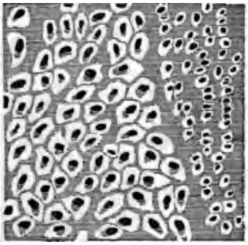

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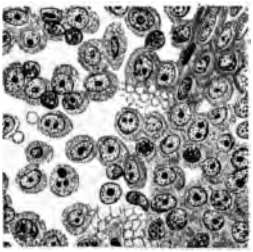

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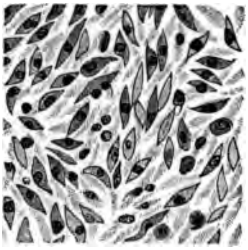

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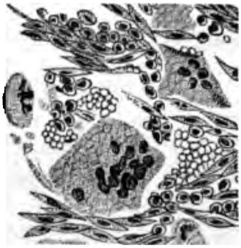

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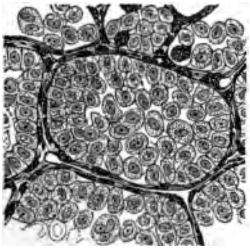

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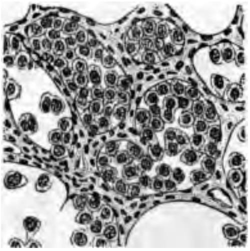

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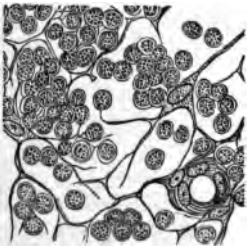

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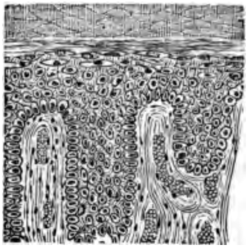

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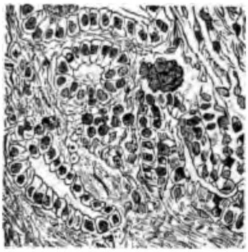

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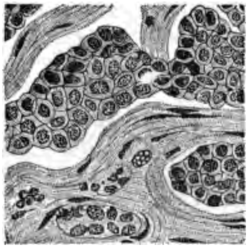

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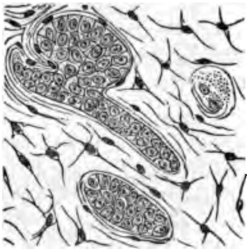

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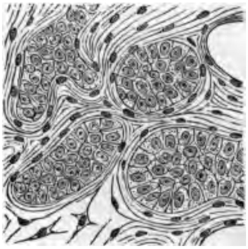

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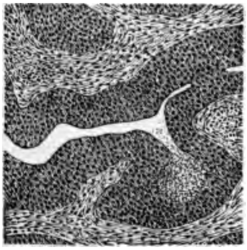

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COMPEND OF PATHOLOGY.

PATHOLOGY is a branch of scientific medicine which embraces the study of diseased conditions or changes occurring within the human organism. Pathology may be general or special, medical or surgical.

MORBID PHYSIOLOGY embraces the study of changes in function.

MORBID ANATOMY considers changes in structure, and is based upon the phenomena of the nutrition, etc., of cells, together with a consequent anatomical or chemical change.

The attention of scientists was first drawn toward cell formation by Schneiden and Schwann in about 1838, Goodsir in 1848, Virchow, 1858.

CELLS.—Cells originate by—

(1.) **Simple or Direct Cell Division, Amytosis.**—The nucleus enlarges, and finally a division occurs in both the nucleus and cell. Ameboid cells usually adopt this method of division.

(2.) **Budding** is a simple constriction and subsequent separation of any part of the protoplasm of a cell. Both the above methods of cell division may be physiological as well as pathological.

(3.) **Endogenous Cell Formation.**—A cell forms within a cell, subsequently vanishing, leaving a space. This process, which is pathological, is nicely illustrated in cancer.

(4.) **Nucleated Protoplasm.**—Young and soft cells, without walls, fuse together and multiply. This is also a pathological process illustrated in Sarcoma.

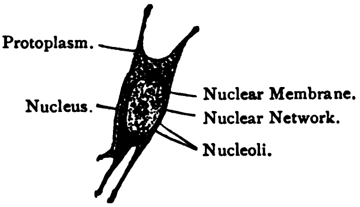

FIG. 1.—Connective-Tissue Corpuscle from the Skin of a Salamander.

(5.) **Indirect Cell Division (Caryocinesis.)**—The most important of any form of cell division. It is known that the nuclei of all living cells, both of the animal and vegetable kingdom, undergo changes before the protoplasm is divided; hence the name, kernel-movement. This nuclear division is a more scientific form of simple division, consisting of a series of ten forms of evolution, as follows:

(1) Nucleus at Rest. The nucleus is composed of a network of threads or filamentary substance arranged in the shape of the letter V, the convex portion being at one side of the nucleus, while the open ends are at the other. (2) Rosette, (3) Aster, (4) Star, (5) Spiral, (6) Equatorial plates, (7) Double star, (8) Double wreath (formation of two nuclei), (9) Double coils, (10) Two distinct nuclei formed.

NORMAL NUTRITION is that function by which new material is substituted for the pre-existing, and of a similar character, that the identity of the part may be preserved. This necessarily involves (1) normal temperature, (2) proper food, (3) normal circulation, (4) a perfectly organized nervous system.

HYPERTROPHY.—An increase in size of an organ or tissue due in cases of simple hypertrophy to merely an enlargement of the cells themselves.

HYPERPLASIA.—Sometimes considered a numerical hypertrophy, signifies an increase in the number of cells, caused by multiplication or proliferation. Hypertrophy may be true or false. The former being caused by increased functional demands. There is no change in the arrangement of the cellular elements, but an increase in function.

In pseudo-hypertrophy the connective tissue is involved with consequent impairment of function. Impaired or diminished nutrition gives rise to atrophies or degenerations.

ATROPHY.—By atrophy, which should not be confounded with arrested development, we mean a diminution in the size or number of the histological elements of which a certain part may be composed. Naturally, there is loss of weight associated with impairment of function.

An organ may be evenly decreased in size when all the tissues are involved, as in old age, or unevenly, when the process is confined to the connective tissue. The color of an atrophied organ is usually darker than normal, because of the retention of the normal pigment. New pigment may originate from broken down albuminates, or may come from the blood. In the latter case the pigment gives a brownish color to the tissues, and is usually caused by chronic congestion.

Atrophy may be due to—(1.) General malnutrition (starvation, etc). (2.) Local diminution of blood supply due to inanition. (3.) Pressure (as in the liver of women who lace). (4.) General or local inactivity, paralysis, etc. (5.) Nervous influences.

Atrophy may be *simple* or *numerical* (diminution in size or decrease in number), the latter being usually an advanced stage of the former, and although we may have the former without the latter, we can never have the numerical without the simple form.

Atrophy may be *general* or *local.*

The latter may be caused by some local condition, while general atrophy is often the result of old age, low vitality, excessive waste, etc., which might arise from fevers, hemorrhages, wasting diseases, etc., but more often from some loss of functional activity which might induce a local anemia. Atrophy is seldom an independent process, but is more or less closely associated with fatty degeneration, as for instance, acute yellow atrophy of the liver.

Atrophies, generally speaking, are changes in quantity, while degenerations are changes in quality.

DEGENERATIONS.—A *degeneration* is a chemical or anatomical alteration in the quality of a tissue, with impairment of function producing a tissue of a lower type.

Degenerations are divided into **Infiltrations and Metamorphoses.**

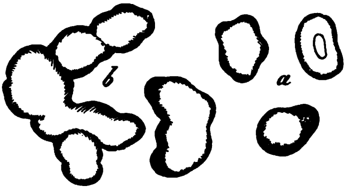

FIG. 2.—Amyloid infiltrated liver-cells. (*a.*) Isolated cells. (*b.*) A fragment of the liver-cell net-work, in which the dividing lines of the individual cells are no longer visible.

INFILTRATIONS.—An *infiltration* is a process in which there is a superaddition, from the blood, of a normal constituent in excessive quantity (as fat in fatty infiltration), or of an abnormal material (as albuminoid material in albuminoid infiltration) to the cell.

The original constituents retain their identity and function, and the organs their shape.

Infiltrations, with the exception of the albuminoid infiltration, usually terminate favorably.

METAMORPHOSES (**true degenerations**).—There is a conversion of the cell protoplasm into abnormal material or into an excessive proportion of normal tissue. The albuminoid constituents of the tissues become changed within the cells. The shape of the organ is lost, function badly impaired, and recovery seldom complete except in cloudy swelling.

Infiltrations are Fatty, Albuminoid, Pigmentary and Calcareous.

FATTY INFILTRATION is the addition of fat or oil, derived from the blood, to the cell. External metabolism. The protoplasm is pushed to one side (not necessarily destroyed as in fatty degeneration), giving a "seal ring" appearance, as in colloid metamorphoses.

Synonyms.—Fat dyscrasia, adipose degeneration.

Physiological Example.—Liver after meals, marrow of bone, adipose tissue, obesity, intermuscular connective tissue. Fat is never deposited in the ears, eyelids, alæ-nasæ, lips, or the areolar tissue of the penis.

Fat may be deposited locally or generally. As an example of the former, we have Lipoma.

Cause. Fatty dyscrasia, non-oxygenation, excessive use of alcohol or sugar.

Macroscopical.—The organs are enlarged, pale and friable. The cells are much enlarged and appear like vesicles, having a thin wall of protoplasm, within which is contained one or two globules of fat. These may unite, pushing the cell-substance and nucleus aside, but as soon as the fat is removed the nuclei and protoplasm resume their normal position, shape and functions.

When the liver is involved, a fatty infiltration differs from fatty degeneration, because of the tendency toward union of the fat-globules in the former, while degenerations usually involve the peripheral areas of the lobule.

In the heart, degeneration affects the muscular fibres, while infiltrations usually affect the intermuscular connective tissue.

ALBUMINOID INFILTRATION.—A deposition from the blood of a neutral albuminate into the tissues. Beginning in the coats of the small vessels, it leads to their complete transformation into a bulky, wax-like substance; later subsiding, the process either involves or destroys, by pressure, the surrounding tissues, until an organ may become almost a solid mass of albuminoid material.

Synonyms.—Lardaceous, bacony, waxy, amyloid. Amylaceous bodies having a concentric arrangement, resembling starch granules, are found in the prostate gland. They appear like small grains of sand, the cells having undergone albuminoid degeneration and united in concentric circles.

These bodies are also found in the membranes of the spinal cord and brain, in locomotor ataxia and epilepsy, and in the lungs in emphysema.

Seat.—The process usually involves, primarily, the intima of the blood-vessels of the liver, spleen, intestines; later, the process may extend to the adventitia, parenchyma and connective tissue generally. The process may be general or local; the latter, as seen in sago-spleen, in which case the malpighian bodies alone are involved.

Macroscopical Appearances.—The organs are enlarged and pale, heavy, tough, and translucent at the edges. The color is due to anemia caused by a reduction in the lumen of the vessels—the result of a thickening of the blood-vessel walls. The anemia often leads to a fatty infiltration, which is sometimes found associated with albuminoid infiltration; there are small areas having a clouded appearance due to the loss of the translucency of the cells; this is made conspicuous by the addition of iodine.

Microscopical.—There is an entire disappearance of the normal structure, supplanted by a loss of the translucency of the cells and a consequent cloudy appearance; the cells are enlarged, nodulated (potato shape), and the nuclei are lost.

Chemically, it is a dealkalized albumen. Lugol's sol. and sulph. acid produce a blue color, as with starch, while gentian violet imparts a blue color to the tissues and a pink color to the amylaceous bodies.

Nature and Termination.—Bad. The process seems to be a combination of infiltration and metamorphosis.

CALCAREOUS INFILTRATION.—A deposition of lime and magnesia salts into the intercellular substance; rarely into the cells.

It is a passive process, there being no attempt at ossification, which is an active and living process. Calcified tissues preserve their histological arrangement, while ossified tissues present the structure of bone.

Synonym.—Limy infiltration or degeneration, calcification, calcareous putrefaction.

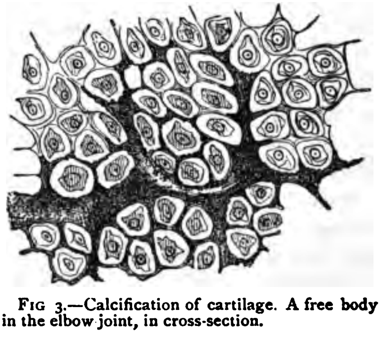

FIG 3.—Calcification of cartilage. A free body in the elbow joint, in cross-section.

Physiological Example.—Ossification of cartilage and bone in the fetus, and calcification of cartilage in old age.

Seat.—The process usually involves cartilage, blood-vessels (the intima and media, the result of chronic inflammation and fatty degeneration), tumors (myoma), thrombi, and cheesy and other degenerations.

Cause.—Deficiency of carbonic acid and albumen in the blood which holds the lime-salts in solution, giving rise to "metastatic calcification."

Impaired nutrition is a frequent cause, as seen in cartilage or myoma, in both of which cases the circulation is poor.

Macroscopical.—The organs are gritty or stony, if uniformly involved; if unevenly affected, the granules may be felt, or even seen in spots (as in the brain).

Microscopical.—The tissues contain dark granules, which give effervescence upon the application of mineral acids.

Chemical.—There are present mixed phosphates and carbonates of lime and magnesia.

Nature and Termination. Favorable.

PIGMENTARY INFILTRATION.—A deposition, usually of the coloring matter (always of an albuminoid nature), of the blood into the cells; rarely into the intercellular substances.

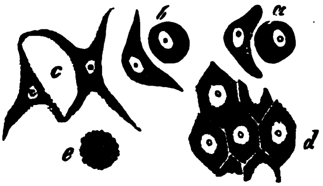

FIG. 4.—Cells in various stages of pigment infiltration. (*a*, *b*, *c*, *e*.) From a pigment-cancer. (*d*.) Pigmented vascular epithelium from same.

Synonym.—Pigmentation, cromatosis, melanosis, jaundice.

Physiologically, it is found in the negro, in the choroid coat of the eye, in the skin, hair, etc.

Varieties.—(1.) True or internal pigmentation may be *hepatogenic* or *hematogenic*. (2.) False or external pigmentation is caused by particles which may gain access to the system and become the source of inflammatory changes leading to pigmentation, as seen in anthracosis argyria, tattooing, etc.

Seat. The tissues affected are usually those exposed to the air, but occasionally, as in the suprarenal capsule, pigmentation is seen upon internal organs, in which cases there is an increased amount of melanin in the skin.

Cause.—Locally, by hemorrhage; ordinarily, by hepatic affections or malaria.

Macroscopical.—The parts are yellow, brown, or black.

Chemical.—The process contains a chloride of hemaglobin.

Nature and Termination.—Good.

METAMORPHOSES.

CLOUDY SWELLING.—An albuminous degeneration of the protoplasm of the cells. By some regarded as an infiltration of serum into the cells.

Synonym.—Albuminoid, parenchymatous metamorphosis.

Physiological Example.—After eating the organs become cloudy and swollen; only the active cells of an organ being involved.

Macroscopical.—Organs are light in color, cloudy and flabby; enlarged without necessarily a change in shape.

Microscopical.—The cells are very much enlarged, even to double their normal size. The protoplasm becomes granular, and later the nucleus, which is obscured, also become granular and ultimately the cells loose their normal shape.

Cause.—Congestion and inflammations, especially those of an infective nature.

Seat.—The process is usually confined to epithelial and muscle cells.

Chemical.—There are granules, which resemble those of the early stages of fatty metamorphoses, but which clear up on the addition of acetic acid—not with ether.

Termination is favorable, or it may become a fatty metamorphosis.

FATTY METAMORPHOSIS.—A transformation of the protoplasm of cells into granular fat, or the separation of the normal fat contained in the cell (internal metabolism).

Synonym.—Necrobiosis, numerical atrophy.

Physiological Example.—Milk formation.

Cause.—The result of a disproportion between the nutrient and the nutrienda. Insufficient quantity of oxygen is the prime cause. This is illustrated in fatty degeneration of the heart, in chloroform poisoning, also in blindness following fatty degeneration of the optic

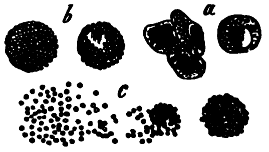

FIG. 5.—The fatty metamorphosis. Epithelium of the pericardium in dropsy of pericardium. (*a*.) Cells which still show the normal form of arrangement. First appearance of fat-globules. (*b*.) Granular globules, the one with a nucleus still visible. (*c*.) Granular globules disintegrating to fatty detritus.

nerve, resulting from excessive hemorrhage. Fatty degeneration may also result from the administration of poisons, anemia, or the deficient or excessive use of a part.

In all inflammations, fatty degeneration may be sooner or later an important factor.

Fatty metamorphosis may be a liquid process, in which case mucoid metamorphosis is usually superadded to the fatty process. The liquid produced is called "pathological milk." Sometimes we find apparently a solid fatty metamorphosis, due to the absorption of the liquid, leaving no caseation. On the other hand, only a part of the product may be affected.

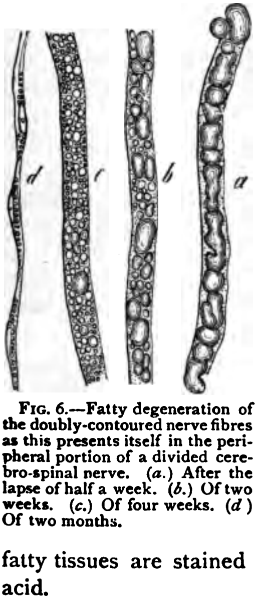

Fig. 6.—Fatty degeneration of the doubly-contoured nerve fibres as this presents itself in the peripheral portion of a divided cerebro-spinal nerve. (*a.*) After the lapse of half a week. (*b.*) Of two weeks. (*c.*) Of four weeks. (*d*) Of two months.

Seat.—The process involves the cells of the connective tissue and of the parenchyma.

Macroscopical.—The organs are atrophied, diminished in size, soft, fatty, friable and of a yellowish color.

Microscopical.—The cells become granular and enlarged, oil globules appear, and finally the nucleus is obscured.

The granule cells are identical with cholestrum corpuscles in milk (corpuscle of Gluge).

We also find granular fat, pus corpuscles, fat crystals, or margaric acid, etc. The fatty tissues are stained black when subjected to the action of osmic acid.

Nature and Termination is bad.

MUCOID METAMORPHOSIS.—A liquefaction of the tissues in which the albuminoid intercellular substance is converted into mucin, giving a material of a soft mucilaginous consistency. This mucin resembles sulphur in composition more than it does chondrin or gelatin; but it does not contain sulphur, is precipitated by acetic acid, and is not soluble in excess of the acid. It is not precipitated by boiling, by bichloride of mercury, or tannin. Its action with the last two reagents distinguishes it from chondrin or gelatin, both of which are precipitated.

Synonym.—Myxomatous metamorphosis. Myxoma. Mucous *tissue* (not mucous membrane). Myxedema is a condition in which all the subcutaneous tissues of the body undergo mucoid change, resembling dropsy, save that the tissues are harder and more elastic.

Physiological Example.—Mucus, secretion of the mucous membranes and mucous glands. Vitreous humor of the eye—umbilical cord. Mucus may be physiologically formed by a degeneration of protoplasm of the secreting epithelial cells.

Seat.—Many authorities contend that only the connective tissues are involved, and that epithelial cells are never subjected to mucoid change, but are prone to colloid degenerations.

Nature and Termination. Bad.

COLLOID METAMORPHOSIS.—A gelatinous degeneration occurring in the epithelial cells, giving as a result a jelly-like albuminate of an acid reaction, and differing from mucoid metamorphosis in containing sulphur, and in not being precipitated by the addition of acetic acid.

The substance forces its way into the cell, pushes the nucleus and protoplasm to one side, destroys the cells, and forms a colloid mass.

Physiological Example.—Thyroid gland, late in life. In the thyroid gland there may be such an extensive formation and accumulation of colloid material as to lead to Goitre. This material may also accumulate in some forms of ovarian tumors.

Microscopical Appearance.—The cells contain small drops of yellowish and gelatinous material. These drops ordinarily unite and are discharged from the cells; but accumulations may occur, which by pressure might obliterate the epithelium, leaving only the connective tissue forming the wall of a colloid cyst. As already shown mucoid and colloid metamorphoses are almost opposite conditions.

Mucoid metamorphosis affects intercellular substances, while the colloid metamorphosis affects the epithelial cells.

In the mucoid the cells form the reticulum, while in the colloid variety the intercellular substance forms the reticulum.

Mucoid is white in color and bulky, as it contains considerable fluid.

Colloid is yellowish in color, having a grape-like appearance, is shrunken, and is not precipitated by alcohol.

Mucoid has round and spindle-shaped cells, separated by a gelatinous substance.

Colloid has a "seal ring" appearance.

Mucoid is alkaline in reaction, contains no sulphur, and is precipitated by the addition of acetic acid.

Colloid is acid, contains sulphur, and is not precipitated by acid.

HYALINE METAMORPHOSIS.—A protoplasmic degeneration of connective tissue into a glass-like substance, resembling amyloid material, but differing from it in chemical composition.

Synonym.—Vitreous metamorphosis.

Seat.—Connective tissue, principally blood-vessel walls. In the brain it affects the adventitia, while in large sclerosed arteries both the intima and media are involved. About the blood-vessels and gland acini of some of the cancers, hyaline rings may be formed. This is especially marked in the stroma of certain endothelioma and cylindroma. The process may invade the brain, lymph glands or ovaries, and is found in the lesions of syphilis, tuberculosis, and diphtheria.

NECROSIS.—The death of a circumscribed area of tissue.

Varieties.—Necrosis, coagulation necrosis, cheesy necrosis, liquefaction necrosis and gangrene.

Cause.—Insufficient blood supply, chemical or mechanical destructive processes, nervous conditions (vaso-motor), extreme degrees of temperature, etc.

The products of the process may be:

(1.) *Absorbed*—In which case the parts are broken down, emulsified and absorbed by the blood-vessels and lymphatic systems.

(2.) *Retained*—A connective tissue wall is formed about the dead cells, which either become liquified, thus forming a cyst, or there is caseation and calcification.

(3.) *Discharged*—This may be accomplished either (*a*) by degrees, in which case there is suppuration, or (*b*) as a whole, by gangrene, when a line of demarcation would be formed and the entire mass expelled.

Reparation of the destroyed area may be accomplished by (1) the formation of connective tissues. (2) the formation of a tissue resembling that destroyed.

COAGULATION NECROSIS.—The clotting of blood.

Cause. Simple coagulation necrosis is usually caused by an obstruction in the circulation supplying a part, as in emboli.

Infective coagulation necrosis may be caused by bacteria, as in diphtheria.

Macroscopical.—In simple cases we have clotting of the blood, during which process the blood plaques become adherent, the white cells also unite, and fibrin is formed which retains the red corpuscles, resulting in the formation of a red clot.

In Phthisis, coagulation necrosis is an early result of the infection. The bacteria enter the cavity and immediately the infective process is established.

In Diphtheria we find coagulation necrosis occurring in the mucous membranes, giving rise to a false membrane, of which there may be two forms.

(1.) *Croupous.*—A superficial and mild form affecting the larynx, where there is not much lymphatic tissue. The inflammatory process is confined to the mucous membrane, the cells become shiny, the nuclei lost and the shape of the cell changed, so that a number of these cells resemble a network of coagulated fibrin.

(2.) *Diphtheritic.*—A more intense form, in which the pharynx is involved, and having a tendency toward lymphatic involvement. The fibrin which exists in the epithelial cells and submucous tissues may be absorbed or thrown off. Absorption being dangerous on account of the bacteria.

CHEESY NECROSIS.—A dry, fatty degeneration, resulting in caseation of the albuminous and oily constituents of the tissues.

Synonym.—Caseation.

There may be moist or dry cheesy necrosis, one arising from the other, either, in one case by liquefaction or in the other case by absorption.

Macroscopical.—The process seems to be a mixture of coagulation necrosis and fatty metamorphosis. The foci become encapsulated, soften, and finally cysts form.

In Phthisis, we see the dry cheesy foci liquefy and cavities resulting.

Microscopical.—The cells lose their individuality, the nuclei become indistinct, while the protoplasm is granular.

LIQUEFACTION NECROSIS.—A process resembling coagulation necrosis in detail, save that as the name implies in one case the product becomes coagulated, which never occurs in the other. The process is illustrated in white softening of the brain, blisters, etc.

GANGRENE.—A localized death of tissue in a living body. A death of a part, due to the complete arrest of nutrition, a putrefactive necrosis of tissue in the body.

Cause as stated, by the arrest of nutritive activity or putrefactive changes and the infection of a necrosis with micro-organisms.

Synonym.—Necrosis, putrefaction, mortification. The products of the process are, according to the location: slough, sphacelus, or sequestrum. Gangrene may be dry or moist; general or diffuse and local.

Dry or senile gangrene, mummification, is, as the name indicates, of a dry character, the moisture being absorbed or evaporated.

The process, which proceeds slowly, may occur epidemically or may be the result of occlusion of arteries, old age, the prolonged administration of ergot, or the result of emboli or thrombi.

Physiological.—The process is seen in the umbilical cord. The process is purple in color and has very little odor.

Moist or hospital gangrene occurs more frequently than dry gangrene, being an oxidation process.

Macroscopical.—The tissues are of a greenish or brownish color and of a soft or semi-fluid consistency. The surrounding tissues are inflamed, swollen and edematous, pit and crackle upon pressure, resembling emphysema, but the latter does not contain gas.

Microscopical.—The process resembles fatty degeneration, containing triple phosphates, leucin, tyrosin, fat crystals, etc.

Cause.—Venous stagnation, hemorrhages into the tissues, the obliteration of veins, or of both veins and arteries, excessive heat or cold, injuries, etc.

Seat.—May involve any structure.

Termination is favorable when line of demarcation is formed through reactive inflammation and subsequent separation of the part. Termination is unfavorable when septicemia or pyemia is established, due to the absorption of putrid matter into the blood. This rarely occurs in the extremities, owing to obstruction of the blood-vessels by thrombi.

INFLAMMATION.

INFLAMMATION is a molecular change in a tissue, due to an irritant, provided that irritant does not produce death.

A series of changes of an eliminative nature occurring in a living tissue as the result of some irritation, provided it does not destroy the vitality of the part.

Cause.—The injury may be (*a*) *External*, as the result of heat, cold, trauma; any of which may destroy a cell, which in turn becomes a point of irritation, leading to inflammation. (*b*) *Internal.* (1) Changes in the circulation, as embolism, which leads to hemorrhagic infarction causing dead tissue and consequent exciting points. (2.) Disturbances arising from trophic influences, such as myelitis. (3.) Disturbances arising from metabolism, in which cases exciting products may be produced which lead to irritation, either directly or through degeneration. This may be seen in serous membranes associated with Bright's disease. His and Waldayer give the following classification of the primitive tissues of the body:

The *archiblast* comprises three layers of cells; outside is the *parablast* sending prolongations inward, and later leading to the formation of the connective tissue elements of the body.

The newly formed cells are arranged as follows:

Epiblast, or outer layer, furnishes the material for the cutaneous epithelium, the nervous system and neuroglia.

Mesoblast furnishes the material for the genito-urinary organs.

Hypoblast furnishes the origin of the epithelium of respiratory and digestive systems.

Archiblastic or parenchymatous changes usually indicate organic lesion. These changes may be of two classes, degenerative or prolific. As degenerative changes, we have products which are no doubt secondary to parablastic inflammation. In prolific changes there are hypoblastic changes, caryocinesis, exudation, proliferation, etc.

Parablast, which develops later than the archiblastic tissue, and from, as yet, an undecided origin, furnishes material for the connective and lymphatic tissues, under which general heading are included bone, cartilage, fat, blood-vessels, blood-cells, true endothelial and lymphatic cells.

As a result of inflammatory conditions we find changes in (1) the blood-vessels, (2) the connective tissues surrounding the blood-vessels, (3) connective tissue elements, (4) archiblastic elements.

Upon examining an inflammatory process we find primarily a contraction of the minute arterioles, later, dilatation of the blood-vessels, speeding of the current in the arteries, veins and capillaries. Then slowing and stasis, marked at the centre of the inflammation. Finally, the leucocytes begin to collect within the vessels, attach themselves to the walls which have become degenerated, and later there is migration of the leucocytes and red blood corpuscles (the diapedesis of which is especially marked in pneumonia, giving rise to the rusty sputa), causing the destruction of the tissue, the result of the injury produced as well as of the pathological condition of the part.

The white corpuscles adhere to the blood-vessels, giving us a typical inflammation, *i. e.*, there are red corpuscles between aggregations of the white corpuscles, which obscure the blood-vessels. The leucocytes aided by their ameboid powers, work through the tissues, often reaching the surface in the form of pus.

Diapedesis leads to changes in the connective tissues which are of a restorative character, having a tendency to build up the tissues after the leucocytes have eliminated the source of irritation. There is a rapid proliferation; fatty metamorphosis is established, and there may be liquid necrosis of the connective tissue cells. These cells are round, ameboid and resemble leucocytes. The latter (leucocyte) does not undergo caryocinesis: has considerable protoplasm, with a small and irregular nucleus. The connective tissue cell has a large nucleus, less protoplasm and is subject to caryocinesis.

An inflammatory exudate occurs at about the time of the outwandering of the blood corpuscles.

In chronic inflammation there is often a pathological exudation of serum from the vessels, associated with a migration of the leucocytes, and an extensive and progressive multiplication of the corpuscular elements, giving rise to the formation of a dense scar tissue. It becomes necrosed, except under favorable circumstances.

Symptoms.—The phenomena of inflammation gives rise to the symptoms, which are:

Redness.—The degree of which is dependent upon the amount of blood in the part, and varies in intensity in proportion to the violence of the injury inflicted and damage done, as well as to the thickness of the overlying tissues. The color is more vivid in the early stages of the process. Redness disappears when an inflammation becomes chronic as well as after death.

Heat is due to the friction of the increased amount of fluid present as well as to the disintegration and destruction of the particles of the part.

Swelling is due to the presence of the foreign exudate in the tissues, distension of the vessels and to the proliferation of the cells. The swelling is naturally greater where the tissues are relaxed, and may be altogether absent in slight inflammatory conditions or where the skin and tissues are very tense or where the lymphatics are very active, because the fluid's contents, causing swelling, are carried off through the lymphatics.

Pain is due to tension and pressure upon nerve structures. It is intense in all parts, liberally supplied with sensory nerves as serous membranes. Pain is less severe when the process is located in one of the internal organs, which latter are usually poor in sensory nerves.

Impairment of function is due to the injury to which every tissue is subjected when inflamed. Inflammation facilitates the passage of an exudate, which occurs by means of a filtering process through the walls.

Exudates may be serous, catarrhal, purulent, hemorrhagic or fibrinous, according to their consistency. Most inflammations commence with active hyperemia, and are usually of the interstitial type.

When chronic, the result of continued inflammatory processes or points of irritation. The process usually terminates in induration of the connective tissue, fatty degeneration or calcification, with consequent contraction of the part, and cold abscesses may form.

Every acute inflammation gives rise either to the formation of pus and liquid exudate or to cloudy swelling; loss of substance without resolution being established.

We seldom have an inflammation without an emigration of white blood corpuscles and cloudy swelling. Acute inflammations terminate favorably; chronic, unfavorably.

Acute interstitial inflammation may give rise to the formation of abscesses; chronic interstitial inflammation usually leads to sclerosis.

Acute parenchymatous inflammation shows hyperemia and cloudy swelling.

Every catarrhal inflammation when acute presents (1) hyperemia (2) hypersecretion of mucus, (3) desquamation of epithelial cells, (4) follicular suppuration. When it becomes chronic there is added thickening of the mucous membranes from connective tissue overgrowth and fatty metamorphosis.

Every fibrinous inflammation gives rise to adhesions due to connective tissue overgrowth.

The pain and characteristic symptoms disappear with the normal termination of inflammation, which may be divided into two stages. The first stage terminates with the appearance of the exudation. The second ending when the swelling reaches its highest stage.

The terminations of inflammation are:

(1). *Resolution*, which is a more favorable result, inasmuch as the process ceases and the part is restored to its normal condition. It usually occurs during the first stage of the inflammatory process. Any exudate may be absorbed by the lymphatics, and later, when the part is reassuming its normal condition, the veins play quite an important part in the absorption.

Any condition affecting either of these structures (lymphatic or vascular) will naturally interfere with resolution, and sometimes results in caseation or necrosis.

(2). *Organization.*—A process by which a tissue is formed similar to that removed, after a loss of substance. In simple organization the corpuscular exudate is transformed into connective tissue without any loss of substance, as, for example, healing by first intention. New granulation tissue is formed by means of loops of newly-formed blood-vessels, surrounded by round cells and intercellular substance. The cells are principally proliferated embryonal connective tissue cells and leucocytes, which become broken down and consumed.

In organization there are two steps accomplished through the medium of the colorless corpuscles (*a*); in the first step we have presented the epithelial and giant cells, the former containing considerable protoplasm with a small nucleus. The giant cells are formed by a fusion of the epithelioids containing many nuclei and a few fatty cells. Next we come to (*b*) *vascularization*, which occurs, according to public belief, in three ways; but probably most processes are confined to protoplasmic prolongation, there being small protoplasmic threads thrown from one capillary to another and gradually becoming hollowed out, forming a perfect blood-vessel. It is hardly probable that many cases of vascularization are accomplished through the *intervascular* method, in which the blood flows between two columns of cells, or the *intravascular* method, in which a single column of cells has become a tube by the absorption of the ends of the cells. Neither of these methods seem probable, inasmuch as the resulting connective tissue has a great tendency to contract. (*c*). *Cicatrization*, being a conversion of granular into connective tissue.

(3). *Suppuration.*—Here we find an exudation of pus corpuscles which are dead, wandered-out white corpuscles, in various stages of disintegration.

Abscesses, which are circumscribed collections of pus, surrounded by connective tissue walls, may form.

Abscesses terminate in absorption or rupture. In the former case fatty degeneration occurs and the cells are carried away by the lymphatics or veins. When absorption is not complete, caseation occurs. When an abscess ruptures there is a granulation surface left exposed to the air, cells are formed in such abundance that many of them perish, giving rise to pus.

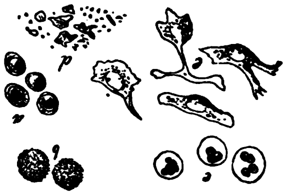

FIG. 7.—Pus-cells. a. From a well granulating wound. b. From an abscess of cellular tissue. c. The same treated with dilute acetic acid. d. From a bone-fistula (necrosis) e. Migrating pus-corpuscles.

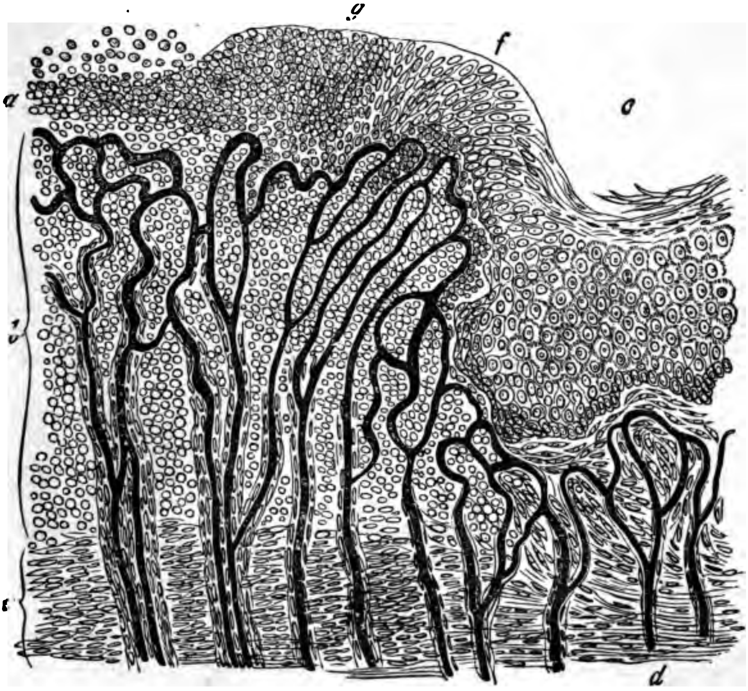

FIG. 8. Section through the border of a healing surface of granulation. a. Secretion of pus. b. Tissue of granulation (germinal tissue) with capillary loops, whose walls consist of a longitudinal layer of cells, decreasing in thickness from within outwards. c. Beginning of the cicatricial formation in the deep layers (spindle-cell tissue). d. Cicatricial tissue. e. Complete epithelial covering. The central layer of cells consists of serrated cells. f. Young epithelial cells. g. Zone of differentiation.

Organization after Suppuration.—A process by which the granulations are formed after the loss of substance, while in simple organization the corpuscular exudate is transformed into connective tissue without any loss of substance, as, for example, healing by first intention.

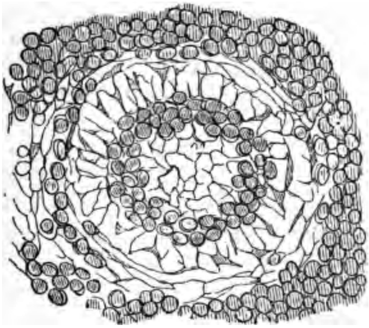

FIG. 9. Lymph follicle, from a fungous granulation (caries fungosa).

Some of the cells become organized tissue constituting the so-called granulations, which are moulds of cells, covering loops of newly-formed vessels. Next we come to the formation of epithelium, either from extension of the epithelial cells on the edge of the ulcer, or from the granulation cells. When neither formation occurs, the papillæ enlarge and we have as a result "proud flesh," in which there is an attempted formation of lymphoid tissue forming the reticulum.

Varieties of inflammatory conditions.

PARENCHYMATOUS.—Many doubt the existence of a process of this type, claiming that archiblastic structures seldom take part in inflammatory conditions.

Parenchymatous or archiblastic inflammations may be divided into two classes: (1) Degenerative. (2) Prolific.

Degenerative inflammations are simply degenerations in the archiblastic structures usually secondary to parablastic conditions, but may occur independently of any inflammatory process.

Prolific inflammations.—Here we find exudative and proliferative changes of an inflammatory character, in which is found multiplication and caryocinetic changes of the cells.

CATARRHAL INFLAMMATIONS, the most common of archiblastic inflammations. There is a proliferative inflammation of a surface protected by archiblastic cells, which upon examination are found to be in a caryocinetic state. The blood-vessels become distended and the leucocytes perform their function of attempting to eliminate the source of irritation by outwandering. This process is nicely illustrated in pneumonia, in which case the cells of the archiblast are destroyed by the pneumococcus; after this there is proliferation of the active archiblastic cells supplying the places of those which have become dead. These latter are softened and removed by the exudation of the leucocytes.

Of the catarrhal inflammations there may be mentioned:

Mucous Catarrhal Inflammation.—This condition is illustrated by acute bronchitis. The goblet cells, being increased, discharge as a whole, instead of discharging the mucus contained in them.

Purulent Catarrhal Inflammation.—A suppurative condition of a mucous surface with parablastic involvement, in which there is an excessive emigration of white blood cells. There may or may not be fibrin or serum with the excessive quantity of pus cells.

Desquamative Catarrhal Inflammation.—In this condition there is an accumulation of epithelial cells, usually occurring in tubes or cavities where there is no means of escape. Later they are discharged.

Follicular Catarrhal Inflammation is a condition involving the follicles and glands of the mucous membranes.

Interstitial Inflammation.—In this condition there is involvement of the connective tissue of a productive nature, while exudation and congestion are usually absent.

Suppurative Inflammation.—This form of inflammation, usually due to the presence and growth of bacteria, is accompanied by a copious exudation of fluid and solid elements. The staphylococcus and streptococcus pyogenes are the most common form of bacteria found in these conditions. Liquefaction necrosis plays an important part, while the surrounding tissues are hardly involved.

Abscess may be *acute*, in which case there is hyperemia and an elevated temperature. In *chronic* abscess there is little hyperemia and a nearly normal temperature. Abscesses may be *iodiapathic*, arising from a point of infection, or *metastatic* when occurring secondary to or distributed by a primary process. Abscess, as stated before, is a circumscribed collection of pus surrounded by a connective tissue wall, usually the result of a suppurative process, associated with which there is congestion, exudation of serum, emigration of white blood corpuscles and death of portions of the tissues. This dead tissue becomes softened, breaks down, and thus cavities are formed containing fragments of the dead tissues, pus and serum. When healing occurs the cavities become filled with granulations, and later with cicatricial tissue. Should a reparative process not occur, fistulous openings or tracts may result.

Phlegmonous Inflammation occurs when a pyogenic membrane or retaining wall is destroyed or does not form about the abscess. In such cases extensive suppurative or purulent inflammation may occur. When there is much fibrin present the process is termed fibro-purulent, which is often found involving such membranes as the peritoneum.

Arterio-capillary Fibrosis.—A chronic inflammatory process affecting the connective tissue, especially that of the blood-vessels of the whole body, though the kidneys and liver are the usual seats. The process resembles atheroma, and is probably due to the circulation of poisonous or injurious bodies throughout the system, although the process is often seen in old age. There is an increase in the connective tissue of the vessel walls as well as of the connective tissue cells, resulting from connective tissue proliferation, obliteration of old blood vessels and degeneration of parenchyma, leaving a larger proportion of connective tissue. In the nervous system there would be an increase in neuroglia, while in the liver there is often proliferation of epithelium.

INFLAMMATIONS OF SEROUS MEMBRANES.—These conditions vary in character and intensity, as do all inflammations.

The phenomena begin with hyperemia and outwandering of the cells and lymph into the serous cavities.

The surface becomes dull, vascular, opaque and velvety, due to the fibrinous exudate.

Macroscopical.—This mass is exuded in the line of the blood vessels, and beneath the endothelial layer.

We find the exudate deposited in small piles resembling miliary tuberculosis, but composed of unorganized lymphoid cells entangled in the fibrin.

Later, the endothelial cells desquamate freely, and together with the out-wandered lymph cells and fibrin form a thick, grayish material which is deposited upon the serous surfaces; this, from continual rubbing, soon assumes a bread and butter appearance. At this stage of the inflammation, the nature of the termination depends upon the intensity of the process as well as upon the processes of (1) resolution, (2) organization, (3) suppuration.

(*1.*) *Resolution.* By this expression we mean that the inflammatory process ceases, and the part becomes normal again.

When a tissue has been replaced by granulation, ulceration, suppuration, gangrene, etc., resolution is impossible.

In *acute inflammations*, recovery is the result of absorption of the exudate, which becomes liquefied through a fatty degeneration of the cells, together with a mucoid change occurring in the fibrin.

If the exudate is not readily absorbed it becomes organized, and leads to adhesive inflammation.

(2.) **Organization.**—*Primary Adhesive Inflammation.*—This condition occurs after an exudation has taken place, and when there is not sufficient liquid to keep the walls of the serous membranes from coming in contact with each other.

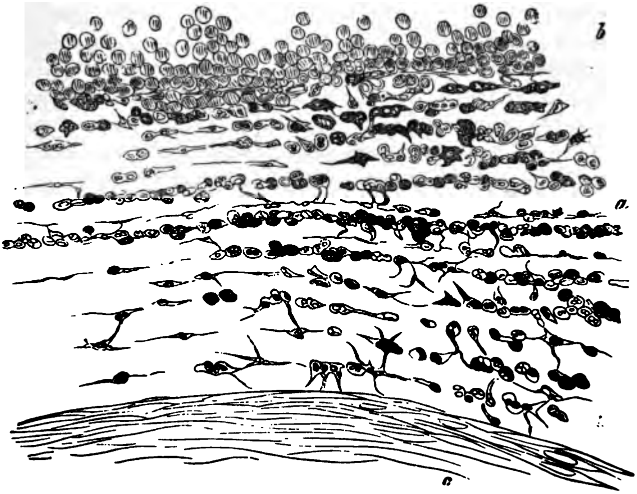

FIG. 10.—Purulent inflammation upon the serosa of the uterus. (*a*.) Serosa infiltrated with colorless blood corpuscles. (*b*.) Surface secreting pus corpuscles. (*c*.) Muscular structure.

When such a condition exists, we find adhesion and union resulting with the formation of connective tissue, just as it forms in incised wounds. The exuded cells play an important part in organization of the connective tissue bands, which form the adhesions, while the fibrin acts as a temporary support and framework for the cells; later, this framework becomes absorbed.

The blood supply comes from the vessels of the affected tissues by means of protoplasmic prolongations of the cell. We find these adhesions forming most frequently in localities where there is little motion, as at the apices of the lungs.

There may be adhesion by first, second or third intention.

Adhesion by first intention is the primary adhesion of two serous surfaces, which is often illustrated in the pleural sacs, where there has not been an effusion of liquid, and when union occurs at once.

Adhesion by second intention occurs when there has been an effusion of liquid, and union takes place after its absorption.

Adhesion by third intention.—This condition we find resulting from suppurative inflammation of a serous membrane, as in empyema. Here we find a process of great intensity and long duration.

Pus is formed in large quantities, which is rendered purulent by the excessive exudation of blood corpuscles. With the involvement of the connective tissue, we find granulations formed, which give rise to an abundant supply of pus, as does any granulating wound. With the removal of the pus the suppurative process disappears, the granulation tissue becomes fibrous, and union occurs between the serous surfaces. With this change there will be thickening of the serous membranes and retraction, such as may be seen in old cases of pleurisy, when the chest wall becomes retracted.

(3.) **Suppuration** is usually secondary, and may be of two kinds. (1) *Primary*, when due to mechanical injury, septicemia, or the rupture of lung cavity, or of an abscess into the pleura. (2) *Secondary*, when adhesions break down or slough away, and union between the surfaces occurs again, after the absorption of the pus.

Effusions of clear liquid are not necessarily due to inflammation, but may be the result of venous hyperemia of the serous membranes.

When air enters a serous cavity, inflammatory conditions usually result, as peritonitis or pleurisy. In empyema, we may have fistula of the lung occurring.

The surfaces on inspection resemble a sloughing ulcer. On healing, there is considerable contraction, the result of thickening of the membranes, due to the overgrowth of the connective tissue, which contraction, naturally leads to disfigurement, even causing curvature of the spine.

Tuberculous inflammations of serous membranes occur, associated with a general process, in scrofulous persons, or may be secondary to a plastic or chronic pleurisy.

Primary tubercular inflammation is a local and plastic process, in which the serous sacs are obliterated by large concretions of fibroid and tubercular material, forming an organized exudate which may ultimately lead to polypoid formations, as seen in pearl disease, when the tubercles and cheesy degenerations are visible.

Secondary tubercular inflammation.—In this process there is very little plastic material, but quantities of miliary tubercle, imbedded in the serous membranes.

MUCOUS MEMBRANES.

HISTOLOGY.—Normal mucous membrane is composed of the following tissues: On the free surface there exists a thick, stratified pavement epithelium, the nature of which varies with the location, being *squamous* from the mouth to near the middle of the esophagus.

Speaking generally, we find *squamous epithelium* where protection is necessary, while the columnar epithelium covers surfaces intended for absorption. Under this epithelial covering we find a basement membrane composed of connective tissue with many elastic fibrillæ, forming networks, in which are embedded numerous leucocytes.

This layer is called the *mucosa chorion*, and projects into the epithelium in conical protrusions resembling the villi of the intestines, not only in appearance, but also in nature, serving as they do to facilitate absorption by increasing the extent of the absorptive surface.

The *sub-mucosa* is composed of similarly constructed tissue, being a loose arrangement of involuntary and unstriated muscular tissue, which in the stomach is composed of three layers, while the intestines have but two layers.

In this sub-mucosa we find imbedded the fat cells forming the adipose tissue, the glands as well as the nervous and vascular supplies, which latter, in the intestines, are superficial, exposing them to acute inflammations, while in the esophagus and stomach the vessels are deep seated, rendering them more liable to chronic inflammations.

INFLAMMATIONS OF THE MUCOUS MEMBRANES.—Besides being subjected to acute or chronic inflammation, there are many subdivisions which are worthy of attention.

These are (1) *Catarrhal*, and (2) *Croupous*, which includes membranous, fibroid, plastic and diphtheritic inflammations.

(*1.*) *Catarrhal* is the ordinary process, the features of which we see so often painted. Of course, they vary with the intensity of the process, and may give rise to a purulent exudation, though the more common is the *muco-serous*, or possibly *muco-purulent.* We find here the phenomena characteristic of all inflammations, *i. e.*, redness, swelling, excessive dryness of the mucous membranes, tenderness, and sometimes pain; hypersecretion, desquamation, follicular suppuration and hemorrhage.

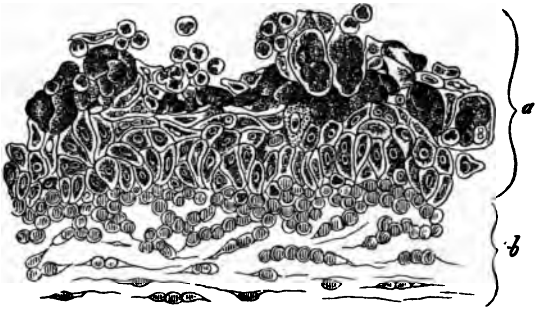

FIG. 11.—Catarrh (purulent) of conjunctiva. (*a.*) Epithelium. (*b.*) Connective tissue stratum of the mucosa.

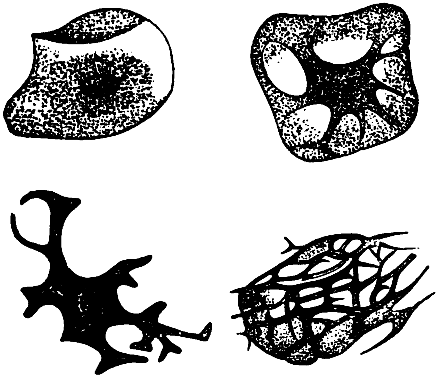

FIG. 12.—Fibrinous degeneration of pavement cells, after E. Wagner.

The dryness is followed by a hypersecretion of viscid, or thin and watery fluid, in which we find many cells. When the process has continued for some time the mass becomes pus-like, while the secretion becomes purulent.

In the simple *mucous* process there is an exudation and degeneration of mucoid material, which may either remain on the surface, and become dried, or flow away with the serous effusion.

This is seen in pharyngitis.

In the *serous* form there is simply an exudation of serous fluid, which is so commonly seen in ordinary colds.

In the *muco-purulent* form there are more serious complications than in the early degenerative processes. The degeneration is more general, and the desquamation of epithelial cells more active.

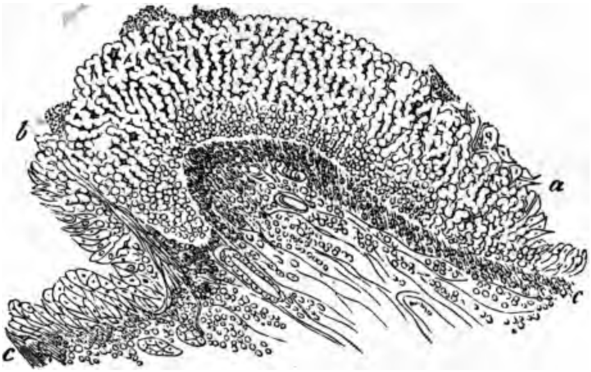

FIG. 13.—Section of a croupous layer of the isthmus faucium, with the fold of mucous membrane lying beneath. (*a-b*) Croupous membrane. (*c.*) Normal mucous membrane.

In the *purulent* form the desquamation of epithelium ceases as well as does the formation of pus. The exudate resembles the pus, while the exudation of leucocytes becomes more rapid.

The mucous glands become enlarged and filled with cells.

Eventually there may be abrasions, ulcerations, follicular suppuration and hemorrhage.

(*2.*) *Croupous processes.*—These differ from the acute form in that they lead to the formation of false membranes upon the mucous surfaces.

This membrane, which varies in thickness and consistency, may cover quite an area, or may occur in patches, usually of a yellowish color and very difficult to remove.

The membrane is composed of coagulated fibrin, in which the desquamated epithelium and cells are imbedded. Under the microscope this is usually found to be the composition, but it is variable, and often consists of an almost entirely different material ; however, it seldom becomes organized.

Many contend that a croupous process in the larynx is merely a laryngeal diphtheria, while others are of the opinion that croup involves only superficial layers of the mucous membranes, while diphtheria involves the mucosa, which depth of involvement naturally renders the removal of the false membrane much more difficult.

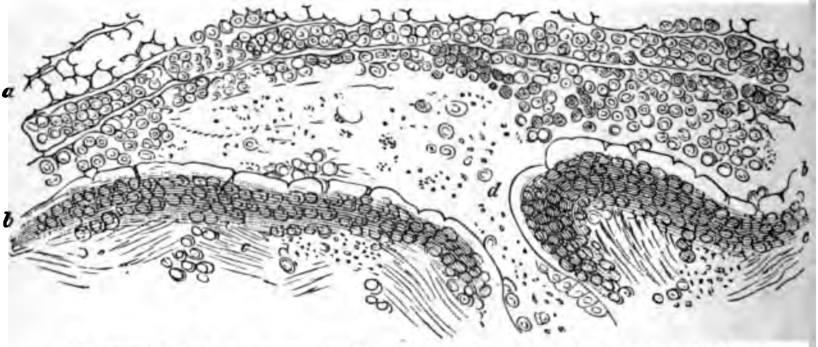

FIG. 14.—Croup of the trachea. (*a*.) The undermost layer of pseudo-membrane (*b*.) The basement membrane. (*c*.) The sub-epithelial germinal tissue. (*d*.) Excretory duct of a mocous gland, from which a clear mucus is evacuated, and lifts off the pseudo-membrane.

Again, many confine the term croup to fibrinous processes, while diphtheria is associated with coagulation necrosis; whichever view is adopted, it is evident that the diphtheritic inflammation is much more serious than the croupous.

Seat.—We find that the *acute inflammations* usually affect the mouth, pharynx and small intestines; more rarely the large intestine. When invading the stomach or esophagus, it is usually caused by some irritant

CROUPOUS INFLAMMATIONS occur in the pharynx and large intestine.

CHRONIC INFLAMMATIONS may occur in any of the above locations save the small intestine.

It is characterized by an overgrowth of the connective tissue, caused by an infiltration into the sub-epithelial layer of quantities of small cells, which give rise to a fibrillated structure. The tissues become thickened and hardened, which may give rise to a great deal of trouble, especially to the glands contained in the sub-mucosa, which sometimes become cysts, from the retention of their normal secretion within their cavities. With this condition we have an enlargement of the lymphatic glands. In follicular pharyngitis we find this nicely illustrated.

HEMORRHAGES AND HEMORRHAGIC INFARCTION occur in the membranes of the stomach and duodenum, causing ulcer.

PUNCTIFORM HEMORRHAGE occurs in the stomach.

SPECIFIC INFLAMMATIONS are usually confined to the small intestine; occasionally the typhoid process extends to the larger gut.

TUMORS.—Squamous epithelioma occurs on tongue, pharynx, esophagus, cardiac end of stomach, and lower part of rectum to within two and one-half inches of the anus (at which point the squamous epithelium ends).

Polyp occurs in nose, pharynx, stomach, and small intestine.

Cylindrical epithelioma, stomach, upper part of the rectum and cecal valve.

Papilloma, in rectum.

Sarcoma (lymphadenoid) affect the tonsil only, which is a lymphoid organ.

SPECIFIC AND OTHER INFLAMMATORY CONDITIONS.

Specific inflammations are due to an irritating parasite or some specific poison, and accompanied by a special product, which is generally added to the product of ordinary inflammation. Specific inflammations are transmitted in various ways, principally by contagion, inoculation and possibly heredity.

They consist of embryonal or granulation tissue, with a tendency to form nodes. The blood-vessels are pressed upon or absent, and consequently degenerations and cheesy changes invariably result, and when healing occurs, the granulation tissue is converted into connective tissue.

SYPHILIS.—A specific inflammation, of an exudative or productive type, accompanied by every inflammatory product, having a course, location and distribution peculiar to itself, and contracted through the pus corpuscle. Primarily, the superficial tissues are involved.

(1.) Primary sore, hard chancre. Being a papula composed of granulation and a few formative cells (wandered-out colorless and epithelial cells).

(2.) Mucous patches on mucous membranes, condylomata in skin, and skin eruptions. The mucous patch is a flat, tabular swelling, having an infiltration of chorion and accompanied by granulation cells.

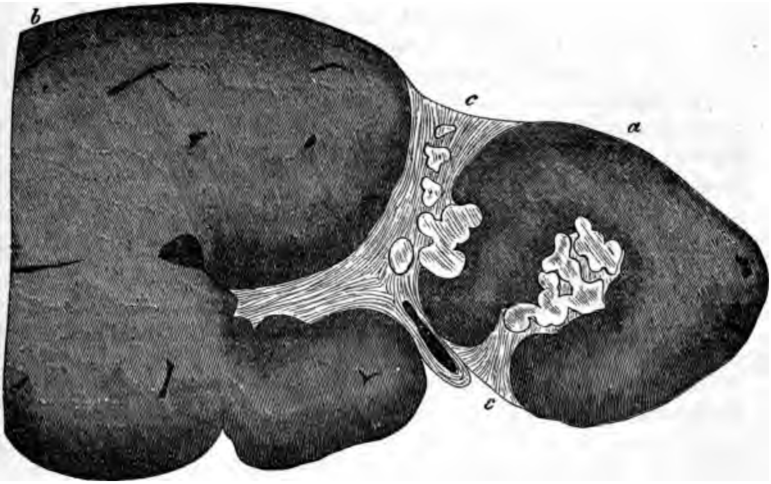

FIG. 15.—Syphilis of liver. (*a.*) Left, (*b.*) Right lobe of liver. (*cc.*) Connective tissue sheath, which penetrates the organ in the direction from the porta to the lig. suspensorium, and contains gummata.

(3.) Fibroid indurations in organs (cirrhosis). These are the least distinct changes, occurring as cicatricial, scar-like growths, thoroughly organized and prone to give rise to ulcerations; they are fixed foci, prone to contract, and usually give the most perfect form of organization witnessed in these troubles. They are sometimes found in the periosteum.

(4.) Syphiloma, or gumma on the periphery of internal organs. Gummata are circumscribed oval nodes, firmly imbedded in connective tissue, resembling the chancre, but the latter does not proceed s far in organization as gumma; the destruction of the latter causes deformity, while the chancre leaves a scar. Gummata cannot be enucleated, while in the sub-mucous tissue they are prone to undergo softening and deep-seated ulceration.

They are usually found in the connective tissue of the liver, kidney and brain.

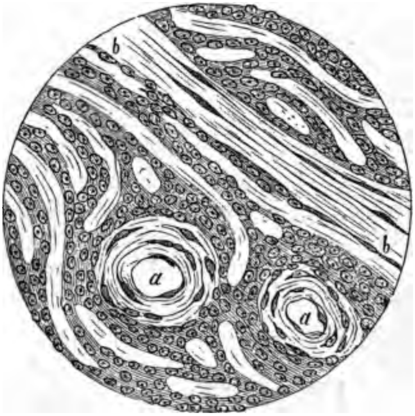

FIG. 16 —Syphilitic induration. (*a.*) Vascular lumina. *bb* and all clear places are bundles of connective tissue, which are pressed asunder by a uniform, small-celled infiltrate.

The gumma has three zones, the outer of which is composed of simple granulation tissue; in the middle zone we find young connective tissue, while in the centre, which is the oldest zone, we find cheesy material and granulation debris. The blood-vessels are more or less occluded, and surrounded by radiating layers of cells, which is very characteristic of the condition.

In congenital syphilis there are no gummata, except in the supra-renal bodies and thymus gland, while in acquired syphilis the gumma is always in the periphery of the organ.

(5.) Changes in the blood-vessels, as atheroma, endarteritis or periarteritis.

SCROFULOSIS.—This is not a disease, but rather a tendency, whereby inflammations are made chronic, and closely resembles tuberculosis.

In scrofula the entire organism seems to be at fault, especially the lymphatic and vascular systems; these conditions invariably result in cheesy products. As an example, we have scrofulosis affecting the sub-mucous tissues, when the product may disappear, either by fatty degeneration and subsequent absorption, or out-wandering of the cells, some of which may find their way into the blood-vessels.

TUBERCULOSIS.—A specific inflammation of an exudative or productive type due to the bacillus tuberculosis, and manifested as a local or general disease—a predisposition being necessary.

The productive type leads to the formation of fibrous tuberculosis, or round-celled tissue.

The exudative forms are associated with the production of serum, fibrin and pus.

Tubercle tissue consists of a basement membrane forming a meshwork in which are imbedded large polygonal and giant cells.

Tubercular inflammations may be circumscribed or diffuse. In the former case we have the miliary tubercle, being a small focus consisting of the products of inflammation.

There is, in tuberculous inflammations, a tendency to become chronic, and consequently cheesy degenerations and necrosis.

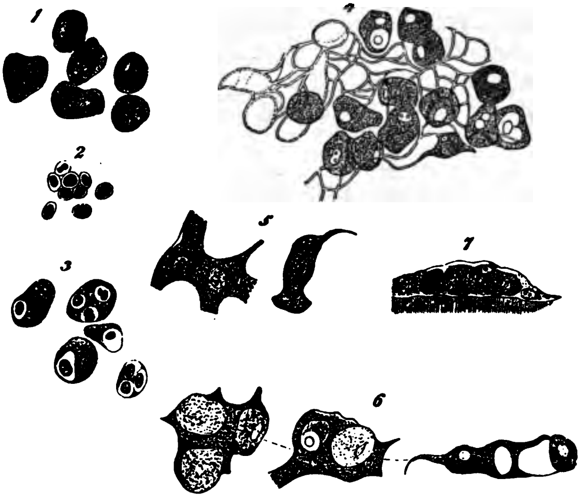

Fig. 17.—Elements of miliary tubercle represented by tearing out. 1. The large tubercle-cells. 2. The small tubercle-cells. 3. Endogenous cell formation. 4. Fine-meshed network from the interior of a miliary tubercle; the cells partly removed by brushing out. 5. Torn off shreds of adventitia of a small cerebral vessel from the surroundings of a miliary tubercle. Division of nuclei at the inner surface of the adventitia. Finely granular protoplasm accumulated in a continuous layer of considerable thickness. 6. Formation of tubercle-cells. 7. The border of a small vessel, in whose adventitia is a development of tubercle-cells.

TUBERCLE is a hyperplastic new formation around an irritated point, caused by a poison. In other words, the tubercle is a nodular swelling, made up of granulation tissue; caused by bacillus tuberculosis. Formerly the yellow, cheesy formation was called a tubercle, but strictly speaking it does not come in that category, although when there is such a close packing of miliary tubercles as to produce a generally fatty degeneration, a product results which is rarely distinguished from yellow tubercle. Tubercle is usually formed in the connective tissue, especially about the blood-vessels.

Of the several tubercles there are—

(1.) *Granulation tubercle.*—This resembles in structure any granulation tissue, except that it has a tendency to form nodes and giant cells, and to undergo cheesy changes.

(2.) *Cheesy tubercle* is a granulation tubercle, which has become degenerated and cheesy.

(3.) *Fibroid tubercle* is one in which the granulation tissue has changed into a scar tissue. Its prognosis is favorable.

(4.) *Tyroma* is an aggregation of multitudes of tubercles into a circumscribed mass.

(5) *Miliary tubercle* is the specific product of tuberculosis, being composed of submiliary tubercles, each of which latter have the following structure:—

A lymphadenoid recticulum, in which are imbedded lymphoid and epithelioid cells, in the centre of which is a giant cell. The blood vessels are either occluded or absent. The miliary tubercle is about the size of a millet seed, of a gray color and opaque.

Cheesy changes occur less frequently in miliary tubercle than in the other tubercle.

Primary, cheesy masses usually infect the walls of the lymphatics later they enter the glands, where for a time the process is arrested; sooner or later the walls are broken down, the blood-vessel's walls become affected and thickened, resembling the course which cancer follows, and from which coincident no doubt arose the erroneous belief that tubercle was a malignant new formation.

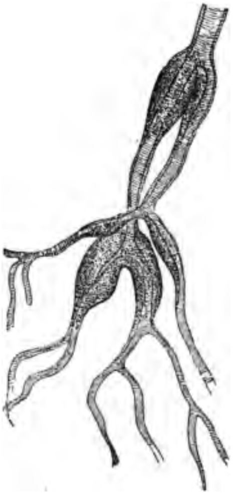

FIG. 18.—Miliary Tubercle Adherent to a Cerebral Vessel.

Every tubercle is an inflammatory formation around a new point. It is never provided with blood-vessels of its own, and does not depend upon its histology for diagnosis. In ulcers of typhoid fever the long diameter of the sore corresponds with the longitudinal line of the gut. The short diameter with the transverse axis.

Miliary tubercle spreads along the line of the lymphatics; as it extends it meets the first line of lymphatics; when the tuberculous process becomes established here it is retarded for some time, but eventually enters the general system, spreading in the same manner as do malignant growths.

LUPUS.—An inflammatory condition affecting the skin and epiblastic mucous membrane, having the tendencies of tuberculous inflammation, and leading to the formation of small multiple nodules of newly-formed tissue, resembling granulation tissue.

Microscopical.—We find the tissues containing epithelioid spherical, and in some cases giant cells, usually grouped about the blood vessels, and often separated by a well-defined reticulum.

There may be connective tissue formation and cicatrization, or the cells and intercellular substance may become disintegrated and ulcerations occurring.

LEPROSY.—A form of inflammation resembling granulation tissue, and characterized by the formation of nodular masses of tissue, composed of large and small fusiform and spheroidal cells. This formation of new tissue may be found in any part of the body, but is usually seen in exposed parts, such as the face, hands, etc. The mucous membrane of the mouth, eye and nose are sometimes the seat of the nodules, which may be large or small, single or in masses. The tissues in which the nodules are situated may become atrophied or hypertrophied, while the nodules may remain a long time intact, or they may soften and break down, leading to the formation of ulcers, which, however, seldom occurs, except in mucous membranes, as the result of external influences, traumatism, etc.

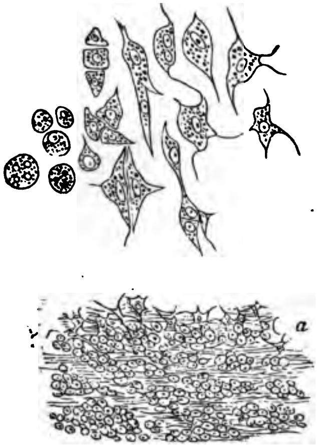

FIG. 19.—*a*. Lepra Tissue, after Virchow. Cells in Division.

ERYSIPELAS.—A phlegmonous process, often accompanied by great dissolution of tissue, which occasionally causes death. It is a diffuse process, involving the skin and subcutaneous tissues with a tendency toward involvement of the lymphatic system, characterized by hyperemia, swelling, and the ordinary constitutional disturbances.

The tissues are infiltrated with serum, which may contain pus; occasionally there are scabs and vesicles, or the tissue may become the seat of abscess or gangrenous degeneration. Associated with the condition there may be parenchymatous degeneration of the liver or kidney, and swelling of the spleen.

It has been claimed that the condition is due to streptococcus erysipelatis, being a large coccus occurring singly, in pairs, or in chains, and of slow growth. They are found abundantly in the lymphatic tissues.

SEPTICEMIA AND PYEMIA.—Inflammatory conditions caused by the presence in the system of micro-organisms. This process may be established by the introduction into and development of bacteria in a wound, or pus from an inflammatory process may be absorbed and circulate in the system, or a chemical poison may be developed from the pus, etc., thus affecting the system.

These processes are limited by the eliminative power of the white corpuscles, and by a line of demarcation formed about the suppurating focus.

ANTHRAX.—Splenic fever. Malignant pustule. Carbuncle. A phlegmonous condition peculiar to the herbivora, but occasionally found in man through inoculation into the system of the bacillus anthracis. This infection may be accomplished through a fly bite or by contact with diseased cattle or their hides.

The condition is characterized by the formation of pustules and papula associated with edema and lymphangitis. There are early ecchymoses in mucous and serous tissues, with the decomposition of the tissues involved.

GLANDERS AND FARCY are conditions resembling anthrax in that they are diseases of cattle occurring in man through infection; nodular in appearance, involving the lymphatic system and resulting in abscess.

The conditions are caused by the bacillus mallei.

TUMORS.

Tumors and morbid growths are swellings or growths of an embryonal character, developing without the symptoms of inflammation, yet all non-inflammatory swellings are not tumors.

Pathological growths are usually painless, originate more or less spontaneously, are permanent, and have an existence of their own, independent of the requirements of the part in which it grows.

In inflammatory conditions there is an apparent cause for the phenomena; and a tendency to disappear. Inflammations disappear spontaneously, and usually create only connective tissue, while in the case of tumors any tissue may result.

Tumors are true hyperplasia. They show multiplicity of cells and have no function.

Hypertrophy shows increase in size only, not in number, while the function of the part usually remains unchanged.

The shape of the tumor depends upon the manner of growth and pressure of the surrounding structure. The composition of the tumor tissue differ from that in which it is seated.

Tumors are vascular, that is, they have blood supplies of their own, even though the tissues simulated may not be so endowed naturally (as in the Lipoma). There are several theories advanced as to the origin of tumors, and while none seem to be universally adopted, many are plausible.

(1.) Hereditary. (2.) Embryonal (congenital tumors). (3) Inflammatory or mechanical, said to be the result of some injury. (4) Dyscrasia (cancers). (5.) Nervous. (6.) Parasitic. Tumors may be single or multiple, and may grow centrally or pheripherally, or both. They are not always confined to the point of primary involvement, but tend to become disseminated, giving rise to metastasis and to metastatic tumors. This is usually seen in malignant tumors, having a rapid growth; those rich in cells and vascular. Tumors may be typical or atypical, according as to whether they resemble their physiological prototype. Tumors may be multiple, as seen in osseous and cartilaginous new formations, but the mere fact of their being multiple does not necessarily imply malignancy, or that they are metastatic. By metastasis is meant an assimilation of elements through blood-vessels, which process is usually accompanied by a condition which rapidly terminates fatally. Metastasis is usually secondary, while multiplicity occurs primarily.

The classification of tumors involves their origin and structure, being based upon the minute structure and origin as well as upon the relationship which the tissue bears to the normal part.

Tumors composed largely of connective tissue:

TUMOR.	PHYSIOLOGICAL TYPE.
Fibroma	Fibrillar connective tissue.
Myxoma	Mucous tissue.
Lipoma	Adipose tissue.
Chondroma	Cartilage.
Osteoma	Bone.
Sarcoma	Embryonal connective tissue.
Glioma	Neuroglia. connective tissue of nerve substance

MUSCULAR TISSUE.

Rhabdo-myoma	Striated tissue.
Leiomyoma	Unstriated tissue.

TUMORS OF EPITHELIAL ORIGIN.

Clavus	Epithelial hypertrophies.
Cornu cutaneum	Epithelium.
Onychoma	Hypertrophied nail tissue.
Icthyosis	Epidermis.
Papilloma	Papillæ.
Adenoma	Gland.

ARTIFICIALLY FORMED HISTIOIDS OF THE EPITHELIAL ORIGIN.

Epithelioma and Carcinoma.

NERVOUS TISSUE TUMORS.

Neuroma	Nerve tissue.

For the sake of simplicity the tumors are classified into three groups.

(1). **SIMPLE OR HISTIOID TUMORS** are those composed almost entirely of tissues of which the body is composed. They consist chiefly of some form of connective tissue; being of mesoblastic origin.

(2). **SARCOMATOUS TUMORS** are composed largely of embryonic tissues, in which there may be an unsuccessful attempt at higher development. The growths, like those of the first-class, are of mesoblastic origin, and are therefore composed of imperfectly developed connective tissue. The growth may be simply a mass of granulation tissue, or there may be a partial formation of fibrous, cartilaginous or osseous tissue.

(3). **CANCEROUS TUMORS** are those in which all the tissue elements may be represented, but are usually present in an erratic or excessive manner. There is a disproportion in the elements of the mesoblast, epiblast and hyperblast, of which the tissues are derived.

SIMPLE TUMORS.—While there are very few tumors in which we find the elements of a single tissue repeated, yet there are a certain number which closely resemble such a structure and are classified accordingly.

Simple tumors grow slowly, are non-malignant, but cause inconvenience by pressure or weight. They usually occur singly, are round or lobulated, and are surrounded by a fibrous capsule.

There may be degenerative processes, as colloid degeneration of the cells, or mucoid degeneration of the connective or fibrous tissues. There may also be fatty degeneration, calcification, ulceration, etc.

SIMPLE HISTIOID OR PARABLASTIC TUMORS—MYXOMA. A tumor composed of delicate connective tissue cells imbedded in a mucoid matrix.

Physiological type.—Mucous tissue found normally in the vitreous humor of the eye in the adult, in which case the cells are round; in the umbilical cord the cells are spindle-shaped; essentially they are embryonic tissue tumors and are non-malignant.

visible to the naked eye.

Macroscopical.—They are round, pediculated and sometimes divided into lobes by connective tissue. They are incased in a fine capsule from which prolongations extend into the tumor mass.

The tissues are gelatinous, soft and fluctuating. Occasionally they present a firm appearance, resembling boiled tapioca. The mass is of a reddish yellow color, due to the rupture and consequent hemorrhages from minute blood-vessels which ramify along the trabeculae which project into the mass.

Microscopical.—We find a shining mucoid mass containing small, round and stellate cells and young connective tissue cells as well as leucocytes. The escaped blood-cells are in a state of disintegration.

Combinations.—*Pure myxoma*, which is rare, may be (1) *Hyaline*, being of a translucent consistence, in which round cells are found between the branching cells. (2) *Medullary*, which is of a more opaque consistency, due to the presence of numbers of small round cells.

FIBRO MYXOMA.—A tumor containing an excess of fibrous tissue.

MYXOMA LIPOMATODES.—A condition in which the cells contain fat. Myxo-sarcoma, myxo-chondroma.

Seat.—Myxoma may be found anywhere in the connective tissue. They are considered by many to be a degenerated connective tissue.

Age.—Occur usually late in life.

Nature generally benign.

Degenerations.—Fatty, hemorrhagic and colloid and mucoid of the cells. They do not give metastasis to internal organs and seldom recur after removal, though when associated with lipoma or sarcoma they are more malignant.

FIBROMA.—May be (1) *hard*, (2) *soft* or (3) *cavernous*.

Physiological.—Areolar and fibrillar connective tissue.

HARD FIBROMA.—**Macroscopical.** Consists of bundles of fibres, and only a few cells and very few blood-vessels, and these not having well-defined walls. The tissues are firm and shining, of a white or brownish color, round or lobulated in shape and encapsulated. Upon section the tumor presents a waxy appearance. Each lobule consists of a number of fibrous and radiating bands arising at the centre, at which point the tissues are softer. In the intervening spaces we find loose connective tissue, in which the blood-vessels ramify.

The tumor is of slow growth and usually single, except when the skin is involved, in which case they may be multiple.

SOFT FIBROMA, which is really young connective tissue, contains less fibrous tissue and more cells than the hard form.

Physiological type.—Loose connective tissue.

Macroscopical.—When involving the skin they are usually soft, multiple and small. Though they may grow quite large and become lobulated, resembling lipoma.

Microscopical.—We find comparatively little difference between the hard and soft variety, save that the hard fibroma simulates the fibrillar connective tissue and is peculiar for the tightness of the interweaving of the fibres, while the soft variety finds its prototype in the loose areolar tissue, and has a very loose arrangement.

Seat.—The fibroma is usually found in mucous, muscular or subcutaneous connective tissue.

When affecting the mammary gland they are often mistaken for sarcoma. They grow centrally and are usually encapsulated.

Nature.—Typically benign.

Age.—They are seldom found in children, but in middle or advanced life.

Combinations.—Fibro myoma, lipoma, sarcoma, chondroma and myxoma.

Degenerations.—Calcareous infiltration, in which case the tumor may be largely composed of lime. This process involves the central nodules, not the parts near the blood-vessels.

Mucoid degeneration of the fibres and fatty degeneration, especially in cases of syphilitic origin.

EDEMATOUS FIBROMA.—A condition in which the tumor has absorbed liquid and resembles myxoma.

KELOID is a peculiar form of fibroma, arising from cicatricial tissue of a benign nature, but having a strong tendency to return when removed.

They are flat, highly vascular swellings, having an irregular outline, being composed of fibrous tissue and may contain many cells.

GLIOMA.—Physiological Type. Neuroglia, which while acting as a connective tissue, is in reality a cement, being less fibrous than ordinary connective tissue.

Macroscopical.—When affecting the pores glioma simulates a hypertrophy, and in general resembles brain substance enlarged. It grows slowly, usually singly and gradually merges into and replaces the nerve tissue.

Microscopical.—The tumor is composed of neuroglia cells having prominent nuclei, which are grouped about the small blood-vessels. There are quantities of cells, the protoplasm of which is granular, and in which are imbedded ovoid nuclei; the latter are large and surrounded by only a little protoplasm, which extends into the filaments.

Seat.—Brain, nerves, suprarenal capsules.

Age.—Most common in childhood.

Nature.—Benign, but may cause death through pressure, or may extend through continuity.

Combinations.—Fibroma, sarcoma, myxoma.

It is rarely combined with other tumors.

A hemorrhagic glioma is one rich in blood-vessels and consequently liable to bleed.

Sarcoma of the retina is often mistaken for glioma.

Degenerations.—Fatty or calcareous.

LIPOMA.—Physiological Type. Fat or adipose tissue.

Macroscopical.—Lipoma is the simplest and most common of all tumors. It is composed of fatty or adipose tissue, and is usually associated with pre-existing tissue of this nature.

It is of slow growth, but may become quite large, round or lobulated, circumscribed and soft.

It may be multiple, and hence should be removed early. It contains a well-developed fibrous wall, from which septa radiate, dividing the mass into lobules.

On section we find a mass of yellowish adipose tissue, in which are seen white and shining septa, containing the blood-vessels of the tumor, which of itself is much softer than normal fat tissue.

Microscopical.--It resembles normal adipose tissue, save that the fat cells are larger, the tissue more vascular. Aside from the connective tissue cells which are infiltrated with fat, are seen embryonic cells undergoing the same process.

The nucleus of the connective tissue cells is pushed to one side, and the protoplasm of the cell forms a thin coating about the fat globule.

Seat.—Usually located in subcutaneous connective tissue, especially in those parts subjected to external pressure. It is occasionally found in the dura mater or in the sub-mucous tissue of the intestine.

It rarely occurs in the heart, liver, lungs, etc.

Age.—Lipoma usually occurs in the adult.

Combinations are Myxo-Lipoma, in which we find numerous branching myxomatous cells and intercellular mucoid substances. Fibro-Lipoma, Osseous-Lipoma.

Degenerations.—Lipoma does not often change its type, but may undergo muscular softening, becoming opaque and putty-like. Mucoid or calcareous degeneration may occur.

Ulceration may result from an excessive formation of young connective tissue cells.

Nature.—Benign, but may be deleterious through ulceration or gangrene.

CHONDROMA.—Type. Cartilage.

Macroscopical.—The tumor resembles fibroma, having an abundance of connective tissue. It is firm and elastic, though in some cases, as a result of mucoid degeneration, it may become soft and gelatinous, and have a marked tendency to multiply. They are of a round or lobulated form, encapsulated, as are most histioid tumors, having bands separating the lobules from each other, and of a slow growth, though in the adult they may grow quite rapidly.

On section the tumor cuts like cartilage, and where there has been calcification, there is a gritty feeling.

The color is bluish, and the glistening trabeculæ are seen dividing the lobules.

There are different varieties of chondroma resembling the three different kinds of normal cartilage.

(1) Hyaline. (2) Fibroid. (3) Mucoid.

The first variety is the more common, while the last is rarely seen.

HYALINE CHONDROMA is found in bone and rarely grows from pure cartilage. It may be congenital and has cartilage cells embedded in a hyaline matrix.

FIBROID CHONDROMA has the same cellular arrangement, but is imbedded in a connective tissue matrix. The cells are reticular, round and stellate-shaped, and larger than normal. The blood-vessels lie in the intersecting bands, not in the tumor itself.

The alveoli are smaller than those of cancer.

MUCOID CHONDROMA has a reticulum of connective tissue, in which are enclosed the cells, both of which (tissues and cells) are surrounded by a mucoid substance.

Microscopical.—The alveoli of chondroma are smaller than in cancer or normal tissue; the cells are round, reticular, stellate or spindle-shaped and larger than normal. The blood-vessels are found only in the intersecting connective tissue bands, not in the tumor proper.

Seat.—The hyaline variety grows from bone, especially from the phalanges and ends of the metacarpal bones of the fingers and toes. The other varieties are usually found invading connective tissues.

Age.—Lipoma appears at any age. It may be congenital or hereditary. Those growing centrically appear early in life, while those of peripheral growth appear later.

Degenerations are common and occur readily on account of the scarcity of blood-vessels. The tumor is prone to calcification and myxomatous degeneration. Chondromata usually have a heavy capsule. New growths occurring in the lungs never originate in the cartilaginous rings.

Combination.—Osteoma. Sarcoma. Myxoma.

Nature generally benign, but may give metastasis to the lungs.

OSTEOID CHONDROMA.—Type. Callous.

Macroscopical.—It is harder than chondroma, of a pear or spindle-shape and encapsulated.

Microscopical.—The cells are smaller than ordinary bone cells. It does not contain canaliculæ and resembles sarcoma.

Seat.—Usually located on the periosteum of the long bones.

Degeneration.—Ossification.

Nature.—Benign, but often recurs.

MYXO-CHONDROMA.—Macroscopical. A cartilaginous tumor, much softer and of a more gelatinous consistency than chondroma, growing rapidly and of a metastatic nature. The growths are soft, of a brownish color and surrounded by a vascular capsule.

Microscopical.—The arrangement is similar to that of chondroma, having the fibrous capsule and trabeculæ, in which latter are contained the blood-vessels.

The cells near the trabeculae are somewhat flattened, but have a regular arrangement, while near the centre the cells are large, irregular in shape, having long processes, several nuclei and nucleoli.

Age.—Middle life.

Degenerations.—Mucoid, Calcareous and Osseous.

OSTEOMA.—Type. Bone cartilage.

There may be four varieties of osteoma, according to the structure of the growth.

(1) Osteoma durum. (2) Osteoma eburnatum. (3) Osteoma medullosum. (4) Osteoma spongiosum.

The first are degrees of the hard variety and contain no blood-vessels, while the last two are degrees of the softer form.

These tumors might also be classified according to their location into *endostoses*, those growing from the interior of bones, and *exostoses*, those growing from the exterior. The osteomata are hard tumors of comparatively regular outline and slow growth, sometimes arranging themselves symmetrically. They may be congenital or multiple.

Macroscopical.—They are slow growing, enucleated, and may become quite large. The Haversian canals containing the vessels are found running at right angles to the long axis of the bone. There is a periosteal fibrous covering, with a layer of round and small cells and young bone beneath. The normal Haversian systems are present about the Haversian canals.

EXOSTOSES are homologous bony growths.

OSTEOPHYTES are heterologous bony growths.

HYPEROSTOSES.—In general terms include both the above, being an external growth due to chronic inflammation, as seen upon the shoulders and hips of soldiers.

SINOSTOSES.—Growths within cartilage.

Age.—Osteoma occurs in early life.

Degenerations are very rare.

Combinations.—Sarcoma, Lymphoma.

Nature.—Benign, except such cases as may result from pressure.

ANGIOMA.—A tumor composed of dilated blood vessels, some being new formations while others are simply dilated pre-existing vessels. There may be an increased amount of connective tissue between the vessels.

Type.—Blood-vessel tissue.

Angioma may be simple or cavernous.

ANGIOMA SIMPLEX is simply an overgrowth of the capillaries, whereby they are lengthened and widened without increase in number, being a true hypertrophy. They are held together by a certain amount of connective tissue and occasionally the walls may become slightly hypertrophied, while the cells of the surrounding tissues may become atrophied.

In simple angioma (navus, mother's mark), the principal feature is a fusiform and sacculated dilatation of the pre-existing or new vessels.

Macroscopical.—There is a bright red or livid patch of skin surrounded by a number of similar spots, none of which are elevated above the level of the skin.

In other cases, as in hemorrhoids, the dilatation may not be so great; but there is more connective tissue about the vessels, which are small and have thickened walls.

Seat.—The simple angioma is universally found on the exterior of organs (while the cavernous variety may involve the interior). It grows slowly and may involve the muscle. They occur occasionally in glioma—rarely in the kidney, brain, uterus, spleen, bones, mamma.

Age.—Early life.

Degenerations.—Mucous.

Combinations.—Lipoma, glioma, sarcoma, fibroma.

Nature.—Benign. When removed early they do not return.

CAVERNOUS ANGIOMA.—Resembles cavernous bodies of penis.

Macroscopical.—It more closely resembles a tumor than does the simple variety, being slightly raised, often enucleated, hard, and grows slowly, of a bluish color and sometimes reaches large proportions.

Microscopical.—There are cavities in the connective tissue and meshworks of fibrous tissue filled with blood and endothelial cells. Sometimes there is marked evidence of calcification.

Seat.—They are usually found in the liver of old people; also seen about the blood-vessels, brain, skin and submucous tissues.

Age.—Generally occur in advanced life, although it may be congenital.

Nature.—Is benign, but may develop sarcoma. When leading to ulceration or hemorrhage it may be dangerous.

LYMPH-ANGIOMA.—A condition involving the lymphatics in a manner similar to that in which the blood-vessels are involved in angioma. It also has the two forms—*simple and cavernous.* We usually find the simple form, due to a dilatation of the vessels. The cavernous form, with the production of cavities, is not so common.

The lymph-angioma may be congenital, in which case the tongue and lips are usually involved, leading to enlargement, which continues to increase in size after birth.

The condition is known as *macroglossia*, and is commonly seen in cretanism. A kindred affection involving the cheeks or lips is termed *macrocheilia.* Lymph-angioma is rarely acquired.

In *elephantiasis* the condition may exist merely as a dilatation resulting from obstruction in the lymphatics, and usually involving the lower extremities or external genitalia.

Seat.—External skin, tongue, labia, cheeks, etc.

Nature.—Benign. But may become serious if rupturing and leading to lymphorrha.

Degenerations.—It is claimed by many that this condition, when affecting the lymphatics of the kidney, is responsible for chyluria.

LYMPHOMA.—**Type.** Lymphatic gland.

All enlargements of lymphatic glands may be called lymphoma, but only non-inflammatory enlargements are true lymphoma. The growth, therefore, is a true hyperplasia, affecting the glands in succession, usually congenital, and always found in places where lymphoid tissue is normally present.

Hard lymphoma seldom leads to caseation or softening.

Macroscopical.—They occur as solitary masses, growing quite rapidly, and although ordinarily of small size may become large occasionally. They are soft, of a grayish color, resembling brain substance. When hemorrhages have occurred the tissues are of a yellowish or brown color, which might lead to a diagnosis of sarcoma, but the latter is easily eliminated by the histological structure and history.

Lymphoma may be hard or soft. In the former case the consistency may be due to an increase in the fibrous elements and connective tissue. It grows more slowly than the soft variety and does not become so large, while the soft variety is richer in cells.

Seat.—Lymphomata usually involve the cervical, axillary, inguinal, submaxillary or mediastinal regions. In the latter location it is frequently found, and is called " Thoracic cancer."

Soft Lymphoma invade but one gland at a time, while the hard variety (the true lymphoma) affects a series of glands. Many lymphomatous conditions are not, strictly speaking, tumors, but hyperplasia or functional enlargements, as seen in

Syphilitic enlargements.—In which case symmetrical glands are involved, becoming cheesy and indurated, consequently it is a pseudo lymphoma, not having the characters of true lymphoma.

Tubercular enlargements affect single glands, causing softening, but not induration. They are not true lymphoma.

Leukemic enlargements affect glands as well as organs (liver, etc.), a part in which there are no lymphatic foci normally.

Glandular enlargements affecting glands following enlargements of the cervical glands. There is a tendency to form abscesses.

Age.—Lymphoma usually appear in early life.

Nature.—The hard variety is benign, while the soft is usually malignant.

Degenerations.—Lymphoma rarely undergo changes of any kind. True lymphoma does not undergo caseation or softening.

Combination.—Sarcoma.

LYMPHO-SARCOMA.—A condition resembling sarcoma or encephaloid cancer to a certain degree.

Macroscopical.—It resembles lymphoma, but it is more vascular, softer, of a more pinkish color and surrounded by a capsule.

The general color may be brownish, due to rupture of the blood-vessels or extravasation of blood. The tumor grows quite rapidly and is often multiple.

Microscopical.—The structure resembles round-celled sarcoma, but there is such a predomination of lymphatic cells that scarcely anything else is visible save a few blood-vessels and the discolored hemorrhagic masses. The reticulum is more delicate than in the lymphoma, the meshes larger, while the epithelial plates are not so numerous nor so prominent.

Seat.—The process usually begins in the lymphatic glands or tissues of the viscera, from which it gives metastasis, especially to the lungs.

LYMPH-ADENOMA.—(Hodgkin's Disease.) A condition in which we find a general lymphatic enlargement without leukemia, as in this condition there is no marked increase in the number of white corpuscles, but an overgrowth of certain of the lymphoid elements.

The process usually begins with some involvement of the glands of the neck or groin.

It is usually dependent upon lymph-adenoma or some serious constitutional defect, and yet there is rarely any marked change in the blood.

Macroscopical.—The glands which become involved in rotation enlarge; the walls break down, and the neighboring glands become a lobulated mass. The tissues are not so liable to caseate nor so prone to hemorrhage as lymphoma or sarcoma. It occurs as firm and elastic masses and large nodules. There is an increase in the amount of fibrous stroma or reticulum, compressing the lymphoid cells, causing them to die and consequently they are diminished in number.

Microscopical.—There is an increase in the number and activity of the endothelial cells and a subsequent increase in the number and thickness of the bands of the reticulum, leading to a gradual transformation of the latter into a fibrous mass, while the lymphoid cells diminish as the fibrous tissue increases. Finally the surrounding tissues are destroyed by the spreading of the lymph-adenomatous growth.

LYMPHO-SARCOMA.—There is a small number of endothelial plates, scanty reticulum and a great increase in the number of lymphoid cells.

SARCOMA.

PHYSIOLOGICAL TYPE.—Granulation tissue. Embryonic connective tissue. Here we find a class of tumors which, throughout their existence, retain their embryonic type—and toward the end of their growth we find the same predominance of cells over the intercellular substance which is so characteristic of the tumors in infancy. Here we find great quantities of small round cells with an insignificant amount of connective tissue, but later in its life we find the connective tissue maturing and fibrillating, but still retaining its embryonal type.

In this respect the sarcoma differs from other histioid tumors.

The cells diminish in number, many assuming a different form, though the majority of the changeable cells become spindle-shaped.

Sarcoma in general we find to be very vascular, abounding in blood-vessels which have no walls, consequently ramifying in every direction. Sarcoma may grow peripherally or centrally, and although we always find the same structure inside the tumor as that in which it grows, we may also occasionally find extraneous substances, such as connective tissue or bone.

They all grow rapidly, often becoming very large, and may originate in an irritation.

As above stated, they are very vascular and may be cavernous, erectile or pulsating.

When a cut surface is scraped we get a clear juice with cells.

In sarcoma there are three kinds of cells.

(1) *Round cells* which closely resemble the white blood corpuscle, lymph cells, or those of granulation tissue.

In the latter we find granulation cells, fusiform cells and cicatricial tissue.

(2) *Fusiform or spindle-shaped cells* are those of young connective tissue, and are, as the name indicates, long, narrow, thin cells terminating in a fine thread at either end. They are of a higher grade than the round cell, and generally contain a nucleus and sometimes nucleoli.

(3) *The myeloid, giant or mother cells* are made up of nucleated protoplasm and are analagous to those found in the young bones. They are spheroidal and contain many nuclei and several nucleoli. The sarcoma are usually round, and, like other histioid tumors, are generally encapsulated. Although sometimes infiltrating contiguous parts, sarcoma are generally found in the skin, subcutaneous and intermuscular connective tissue, sheath of nerves, periosteum, etc.

Age.—We always find them occurring before the thirty-fifth year.

Nature.—Although they are not, as a class, particularly painful, they are, as a class, malignant. The myeloid variety being the least so.

Instances are quoted in which they have been "completely removed," but they generally recur in the same place. When recurring secondarily they usually affect the lungs, heart, liver. Metastasis is of frequent occurrence, through the medium of the blood-vessels.

The order of malignancy is as follows: Myxo-melanotic, alveolar, lympho-sarcoma osteoid and small round-celled sarcoma.

The following recur, but do not give metastasis: Myeloid or giant-celled.

If a comparatively benign tumor is removed it may return, assuming a more malignant form.

The following recur, and give metastasis: Small spindle-celled, large spindle-celled and large round-celled.

They give metastasis by means of the blood-vessels and rarely affect the lymphatics, though Butlin affirms that they may affect certain glands of the lymphatic system.

None of the Sarcoma give metastasis when involving the head, genito-urinary system, or bone, except the melanotic, which is also the only black tumor, the color of the others being dependent upon their vascularity.

Combinations.—Sarcoma are frequently combined with fibroma, myxoma, lipoma, chondroma, glioma, osteoma, lymphoma and cysts.

Degenerations may be fatty, telangiectatic, osseous, calcareous, pigmentary, cystic or suppurative.

RECURRENT FIBROID (Paget).—Fibro-plastic tumor. This form of sarcoma is frequently seen.

Macroscopical.—They grow rapidly, may become quite large and have a tendency to recur locally, which recurrence, when occurring frequently, usually leads to metastasis of the lungs or vascular organs. In form, the tumor is round or lobulated, being firmly attached to the part from which they grow. On section the tumor is firm and tough, of a reddish color, while the surface has the appearance attributed to the fibroma by the fibrous bands.

Microscopical.—Bundles of cells are seen interweaving in all directions, consequently, upon section the cells are cut in every direction—obliquely, transversely and longitudinally.

The blood-vessels are more highly organized than in the small, round-celled sarcoma, but are fewer in number. The bundles are composed of narrow, elongated "oat-shaped" cells, which are distended by a large nucleus. Between the cells is seen a small quantity of intercellular substance.

Seat.—They are found in connective tissue, especially in fascia, periosteum, also in the breast, kidney, liver, etc.

SMALL SPINDLE-CELLED SARCOMA.—The tumor resembles the Paget in that it recurs locally, when not carefully removed, but seldom gives metastasis.

Macroscopical.—The tumor may become large, and resembles the fibroid in that it is hard, firm and elastic, of a pale and fleshy color, and having the glistening streaks peculiar to the fibroid.

Microscopical.—The general appearances resemble the recurrent fibroid. The cells, which are more perfectly formed and larger than in the Paget tumor, are arranged in bundles ramifying in every direction. Consequently on section we find the cells cut in every manner. Those cut transversely appear round, and in some cases, when cut near the ends, the nuclei are not perceptible; when cut directly through the centre the nucleus is divided.

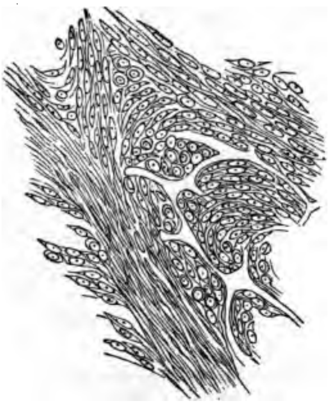

FIG. 20.—Spindle-celled sarcoma. Gaping vascular lumina. The cell lines are divided partly longitudinally, partly transversely.

Seat.—Sheaths of vessels and nerves, subcutaneous and submucous connective tissues, periosteum, bone marrow. The small variety is less malignant than the larger form, and may be combined with fibroma, while the larger variety may become associated with the round-celled sarcoma.

The small spindle-celled sarcoma is diagnosed from fibroma by the extreme rapidity of its growth (fibroma grows slowly) and by their occurring in the extremities of the body where fibroma is hardly ever seen. It is diagnosed from leio-myoma by the action of acetic acid, which dissolves embryonal or sarcomatous cells, but has no action upon muscular cells.

MYELOID SARCOMA.—These tumors consist of a number of different kinds of cells in which the character of the small spindle cells seem to predominate, and conspicuous among which are the giant cells, which latter fact is the diagnostic feature of the myeloid, and yet any sarcoma growing from bone may contain these cells.

Giant cells resemble those found in the medulla, having many nuclei which assume large proportions.

Macroscopical.—The myeloids are firm, hard, encapsulated tumor, growing slowly, assuming considerable size, and usually of a pink or brown color.

In the periphery, which is usually of a lighter color than the centre, may be found small pieces of bone. The centre is darker in color, due to hemorrhagic exudates, while in places may be seen small cysts containing yellowish gelatinous matter resulting from softened tumor tissues.

Hemorrhages and cysts occur frequently from the fact that the vessels are numerous and embryonic in structure. This excessive vascularity has even caused pulsation in instances.

Microscopical.—The bundles of small spindle cells are arranged in the same manner and present the same appearance upon section as has been described.

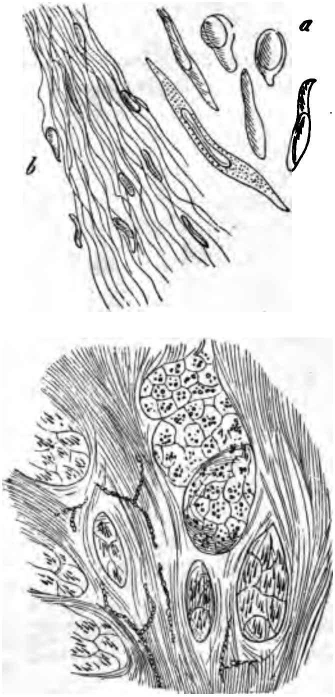

FIG. 21.—Transverse section of a fibroma of uterus. (*a*) Isolated cellular elements. (*b*) An unravelled fasciculus of the fibroma.

The giant cells appear as sections of protoplasm upon which are seen red specks, which are the nuclei, being from ten to twenty in number.

The embryonal blood-vessels are numerous, and around which are seen green aggregations of extravasated blood.

Seat.—The myeloids usually grow from long bones, either under the periosteum or within the shaft or epiphyses, especially upon the lower end of the femur or upper end of tibia, and upon the upper end of the humerus; when occurring upon the jaw they constitute *epulis.* Myeloids are the least malignant of the sarcoma, and are often called osteo-sarcoma; but not every osteo-sarcoma is giant-celled.

LARGE SPINDLE-CELLED SARCOMA.—This tumor is very similar to the small variety, being found in practically the same location, save that the large variety may be found a little more frequently upon the skin. It grows rapidly, seldom becomes large, is often encapsulated and usually very malignant, giving metastasis to the lymphatics, which is followed rapidly by growth in the other organs and tissues, as the liver, brain, pericardium and intestines.

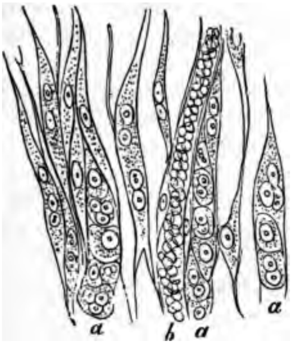

FIG. 22.—Large-celled sarcoma. A place at which colossal spindle cells arranged parallel are mixed with round cells. (*a*) Round cells. (*b*) Vessel.

Macroscopical.—The tumor is softer, larger, more vascular and of a pinker color than the small-celled variety.

Soft gelatinous cysts as well as the hemorrhagic spots of the myeloids are frequently seen in the tumor.

Microscopical.—The cells are much larger and more like the fibro-plastic cells. The nucleus and nucleoli are large and have a tendency to form in meshwork about the blood-vessels, in which meshwork are found some round cells.

There is very little intercellular substance, while the small amount that does exist is not fibrillated. The blood-vessels are numerous and embryonic in character.

MELANOTIC SARCOMA.—This tumor is classed here because of the predominance of the spindle cells in its composition.

Macroscopical—The tumor is very soft, highly vascular, of a dark-brown or blue color and often multiple.

The secondary tumors are softer than the original tumor and often encapsulated.

The pigment is seen collected about the nuclei of the large spindle cells.

The embryonic blood-vessels are surrounded by tissue of a lymphoid character, in which may be seen small extravasations of blood. The coloring matter *melanin* is not true melanin, neither is it derived from the blood pigment, but seems to be eliminated by the large cells of which the tumor is composed.

Seat.—Choroid coat of eye, skin, and pia mater.

The tumor is very malignant, due to the fact that it gives metastasis, not only by the blood-vessels, but also by the lymphatics.

ROUND-CELLED SARCOMA.—It is the simplest and at the same time the most malignant of the sarcoma. It is composed of embryonic or granulation tissue, being the most elementary form of connective tissue. It grows rapidly, gives metastasis by means of the blood-vessels as well as infiltrating locally.

Macroscopical.—The tumor is usually round, although there is no fibrous capsule. It is soft and pulpy, having yellow spots, due to fatty degeneration. Hemorrhages are of frequent occurrence—in fact, the tumor may be so highly vascular as to cause dilatations or varicose conditions of the vessels.

Microscopical.—The cells are large, containing a very large nucleus, and have no cell-wall. Between the cells, there may be a small amount of granular and homogeneous intercellular substance. The blood-vessels are of the embryonic type, and so delicate that they break easily.

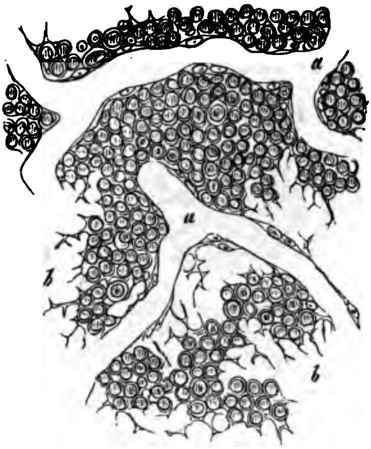

FIG 23.—Round-celled sarcoma (*a*) Vascular lumina. (*b*) Parenchyma partly brushed out, so that the hardened basis-substance appear as an elegant network.

Seat.—It occurs between the fascia, in the loose areolar subcutaneous tissue, connective tissue, muscle, bone, mamma, testes, retina and nerve centres. When it occurs secondarily it invariably involves the lungs and vascular organs. It does not invade lymphatic tissues.

Age.—Usually in youth.

Nature.—The tumor is highly malignant, grows rapidly and termination is unfavorable.

LARGE ROUND-CELLED SARCOMA.—This tumor resembles the small-celled variety, save that the cells are much larger, it is not so malignant, seldom giving metastasis, and is usually found involving the submucous tissues of the pharynx.

Macroscopical.—It appears as a small fibrous polypoid mass, of a pale color, and sharply defined from the surrounding tissues.

Microscopical.—The cells are large, containing from two to four large ovoid nuclei, and consist of considerable protoplasm, in which there is fibrillated intercellular substance.

The cells are divided in groups by the blood-vessels and the bands of intercellular tissue.

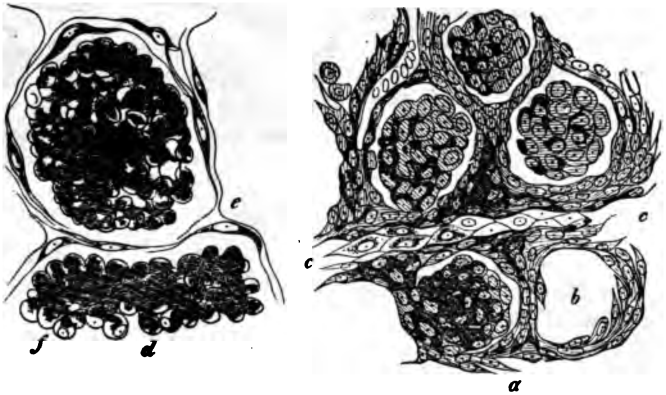

FIG. 24.—(*a.*) Alveolar round celled sarcoma, pigmented. (*b*) Alveolus from which the ball of round cells has fallen out. (*c.*) Vessel with pigmented endothelia. (*d.*) Pigmented round cells. (*e.*) Spindle-cells forming a stroma.

ALVEOLAR SARCOMA.—A tumor consisting of groups of sarcoma cells, contained in connective tissue alveoli, resembling the alveoli of carcinoma, save that in the latter case the cells are of epithelial origin, while in the alveolar sarcoma they are of the connective tissue type.

Macroscopical.—The tumor is of small size, has most of the characteristics of a sarcoma. It is very vascular, even pulsating, and gives metastasis through the lymphatic glands. The tumor is very painful and by many is classified as carcinoma.

It is also the only tumor, with the exception of the melanotic, that is susceptible to pigmentation; when pigmentation occurs, the tumor involves the choroid of the eye and is very malignant.

Microscopical.—Cells are large, round, may have more than one nucleus, are arranged in groups and resemble the epithelial cells.

There is considerable fibrillar tissue associated with the blood-vessels; but they do not ramify in the cell groups.

There is rapid proliferation of endothelial cells without a corresponding increase in the stroma.

Seat.—Tender skin, pia mater, bone and muscle.

The differences between alveolar sarcoma and glandular cancer are:

Alveolar Sarcoma.	*Glandular Cancer.*
(1) Cells adhere to alveoli, are removed with difficulty.	(1) Cells are free.
(2) Cells large, vary in size and have large nuclei.	(2) Cells small and uniform, have small nuclei.
(3) Alveoli composed of sarcomatous material or cells.	(3) Alveoli composed of connective tissue and are dense.
(4) Blood-vessels ramify in all directions.	(4) Blood-vessels contained in connective tissue.
(5) Acetic acid dissolves cells.	(5) Acetic acid does not affect cells.

GRANULATION-LIKE SARCOMA resembles young granulation tissue, and have large nuclei. The intercellular substance is transparent and scanty, while the cells are round and small. The mass resembles fish-roe, is soft and encapsulated.

Seat.—Found in skin, mucous and serous membranes, periosteum and medulla.

Nature.—Very malignant.

Degenerations.—Undergoes mucoid degeneration, which renders it more malignant.

PSAMMOMIA.—A term applied to Sarcoma which contain concentrically arranged masses of spindle cells, containing numerous blood-vessels. There is an infiltration of lime, especially about the centre.

OSTEO-SARCOMA.—A tumor in which there is an actual formation of true bony spicula, both in the primary and secondary growths.

Microscopical.—There are aggregations of cells which take the place of the osteoblasts of bone. Between these cells are bands of fibrous tissue which later become infiltrated with the lime salts.

Seat.—They grow usually in connection with bone, give metastasis by the blood-vessels, leading to the reproduction of similar tumors on other bones.

OSTEOID-SARCOMA.—A variety, described as a process in which there is calcification, but not true ossification: growing primarily from the periosteum, but giving metastasis to the lungs, serous membranes, and other organs.

Difference between sarcoma and cancer:

Sarcoma.	*Cancer.*
Are not hereditary.	May be hereditary.
Have clear liquid.	Contain milky fluid.
Are deep seated.	Are superficial.
Grow upward.	Grow downward.
Occur in young and healthy subjects.	Occur during middle life and old age.
Not painful as a rule.	Are painful.
Grow rapidly.	Grow slowly.
May develop in lymph gland primarily, never secondarily, but may affect them through metastasis, secondarily.	Never develop in lymph glands primarily, but may infect them through metastasis.
Does not contain fat.	Contains fat.
Gives metastasis through blood-vessels.	Gives metastasis through lymphatics (generally).
Blood-vessels have no walls and ramify at will.	Contain true blood-vessels and nerves running only in connective tissue.
Are composed entirely of cells of the embryonal, endothelial, or lymphoid type, which are imbedded in a homogeneous matrix.	Composed of cells of the epithelial type, loosely imbedded in connective tissue spaces.
Cells are more or less small and uniform.	Cells are large, varying in size, containing large nuclei and nucleoli.
Usually encapsulated.	Rarely encapsulated.
Never occur in scrofulous persons.	Secondary cancer usually affects the liver and grows large.
Secondary Sarcoma affects the lung.	

CANCER.

A cancer is a system of channels in pre-existing connective tissue, filled with continuous columns of epithelial cells.

There is an excessive and erratic growth of the tissue elements, giving a highly malignant growth, which gives metastasis locally, as well as to any of the tissues, through the lymphatics and blood-vessels. The growths are of mesoblastic origin, but may invade hypoblastic tissues.

The cancer resembles imperfect racemose glands. Their form is not that of the vesicle, but they are composed of connective tissue, while the typical epithelial cells, which are characterized by their diversity of form and large size, with nucleus and nucleoli correspondingly large, are loosely imbedded in a structure consisting principally of new formations, although the old connective tissue plays an important part.

The Stroma contains the blood-vessels and varies in quality and quantity in the different tumors, the nature of which is governed by the arrangement of the cells and stroma. The cells are small when young and increase in size with age.

Cancers are epithelial and glandular; the simplest form of which is the epithelioma arising from the skin or mucous membranes.

In the glandular type we find a racemose gland rupturing the epithelial cells, wandering out into the surrounding structures and forming roots in the connective tissues.

The classification of cancer is based upon the quantity and quality of the cellular elements in an alveoli, or the quantity, quality and arrangement of the stroma.

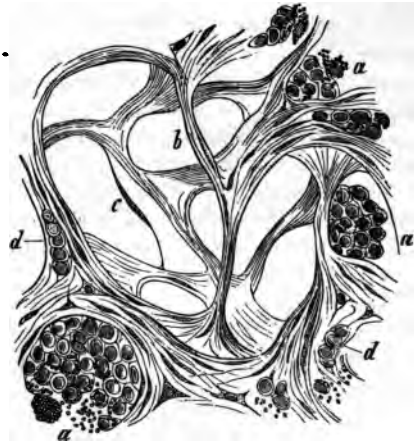

FIG. 25.—Brushed-out Stroma of soft glandular cancer. (*a.*) Section of cylinder of cancer-cells. (*b.*) Trabeculæ of the stroma. (*c.*) A single spindle-cell, which extends from one trabeculæ to another, and by the separation of basis substance along its protoplasm gives the impulse to the formation of a new trabeculæ of the stroma. (*d.*) Round-celled infiltrate in the interior of the trabeculæ of the stroma.

EPHITHELIOMA. — These tumors are *squamous* and *columnar.* The former when originating from surfaces lined with squamous epithelium, and columnar when growing from columnar epithelium. Physiologically the growth resembles the squamous epithelial cells of the skin.

Macroscopical.—It presents a nodular, cauliflower-like appearance, becoming ulcerated and discharging a watery fluid, and is covered with epithelial granulations of a bluish red color, while the edges may be indurated.

On section the tumor is grayish white in color, and firm. Fibrous bands are seen ramifying in the mass, while the blood-vessels are scarce. Upon squeezing the tissues a thick curdy material pops out, as does the paint from an artist's tube.

Microscopical.—Under the microscope we find an excessive growth of squamous epithelium, growing downward in finger-like projections and sending out branching processes

The blood-vessels, which are not numerous, are arranged about these protrusions.

In these columns the epithelial cells become flattened and form the epithelial nests or pearly bodies, which are so characteristic of this tumor and which are of a yellowish color, contrasting with the brown color of the general prolongation.

During the multiplicity, the cells become crowded and flattened upon the periphery, and eventually become dry, horny and brown.

Seat.—The process is usually found at the junction of skin and mucous membrane ; on the lips, tongue, penis, rectum, entrance to the vagina, or other points of exposure or irritation.

Age.—Middle life.

Nature.—Not very malignant, although they may occur secondarily, always in the lymphatic system, through which metastasis is given.

It grows slowly, and consequently the cell nests are well formed, while in rapidly growing tumors the cell nests may be entirely absent.

Degenerations.—Fatty, osseous, calcareous.

COLUMNAR EPITHELIOMA.—*Synonym.* Cylindrical epithelioma, adenoid cancer, adenoma.

Macroscopical.—The tumor resembles the squamous epithelioma; at the same time it seems to be a mixture of adenoma and true cancer.

On section the tumor resembles the encephaloid cancer. There being a quantity of fibro-cellular connective tissue, probably the result of an overgrowth of the normal connective tissue, between the hollow processes.

In the large intestine the process is often found appearing as a soft fungoid growth, which may cover a great deal of tissue. The tumor usually ulcerates.

Microscopical.—The tubes become much enlarged and are lined with a layer of columnar epithelium, while the nucleus is placed in the lower portion of each cell. The small cells may be seen infiltrating into the parts between the glandular tubes, which are widely separated and irregular, due to the great increase in the stroma, which is of a fibrous character and contains a few round cells.

The epithelium varies in quantity and position, so that sometimes the lumen of the tubule is entirely obliterated.

Seat.—It grows from mucous surfaces generally, occurs frequently in the large intestine at the flexures, and in the rectum, in which position it is frequently spoken of as "malignant polypus."

It is also frequently found in the stomach or liver.

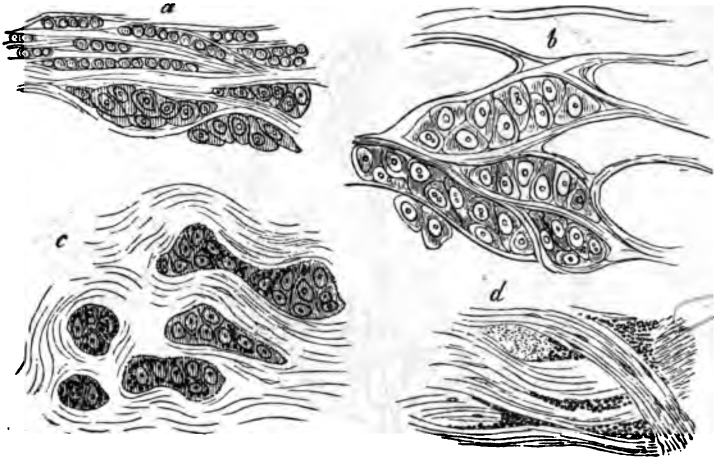

FIG 26.—Carcinoma simplex mammæ. (*a.*) Development of nests of cancer-cells. (*b.*) Fully-formed carcinoma tissue (compare following illustration). (*c.*) Commencing cicatrization; at the same time a representation of the relations of stroma and cells in scirrhus. (*d.*) Cancer cicatrix.

Degenerations.—Colloid or fatty metamorphosis. The tumor gives metastasis and the prognosis is not favorable.

SCIRRHUS CANCER.—Synonym. Hard, simple, connective tissue or chronic cancer.

Macroscopical.—This is a typical cancer, of slow growth. The epithelial cells originate in the hypoblastic, while the stroma and the well-formed blood-vessels come from the mesoblastic tissues.

It occurs as a firm and hard tumor, varying, however, in consistency according to its seat.

In a perfectly developed scirrhus, we find four zones:

(1) *Zone of cicatrization*, being the central zone, consequently we find a mass of dense, hard, fibrous tissue, together with some fatty matter and atrophied cells. The fibrous bands retract, causing a depression, above which the fatty material projects.

This condition naturally interferes with the normal condition of the blood-vessels, which sooner or later become obliterated; hence, the growth of the tumor is arrested at this point, but may progress at another.

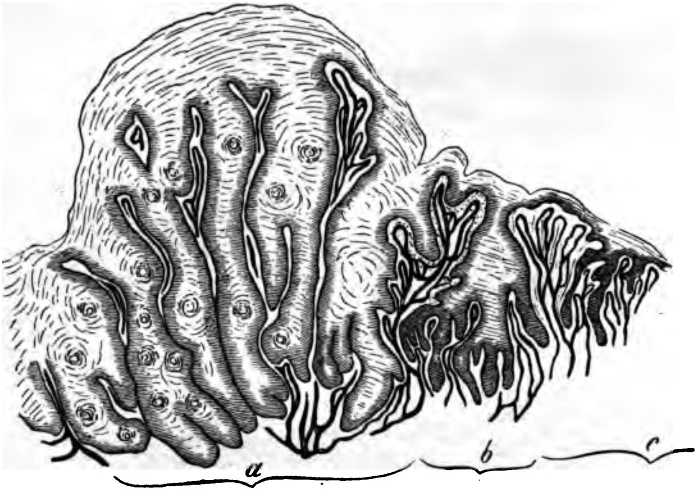

FIG. 27.—From the border of development of an epithelial cancer of the skin. (*a*.) Tumor-mass in full development: cylinder of epithelial cells, with pearly globules, longitudinally divided. (*b*.) An enlarged sebaceous gland. (*c*.) Commencing villiform elongation of the epidermis inwards.

(2) *Zone of degeneration*, due to the rapid growth of the connective tissue and its subsequent cicatrization. These cells are not so active as in the

(3) *Zone of fully developed cancer nests.* Here we find the greatest activity, while the zone is characterized by the alveoli which it contains.

(4) *Zone of peripheral infiltration* contains the young cells from which a section should always be taken for microscopic examination.

The tumor is usually hard and firm, with a depression in the centre due to cicatrization or retraction of the fibrous bands, while in the case of mammary involvement the nipple is depressed.

On scraping we find a milky juice containing many cells. The tissues creak under the knife, and we find little spots of fatty epithelium.

The tumor is of a grayish white color, glistening, containing yellow spots, being hard in the centre and softer toward the periphery. The degree of hardness being governed by age.

Age.—Generally occurs in middle life. (After 35 years.)

Seat.—Mammæ, stomach (pylorus), kidney, rectum, esophagus, testes and ovaries.

Degenerations.—Colloid, fatty and fibroid.

Nature.—Malignant. Giving rise to encephaloids.

ENCEPHALOID CANCER.—*Synonym.* Acute, soft, medullary cancer.

Macroscopical.—Here, as may be expected, we find a condition nearly opposite to hard cancer. The tumors are soft, of rapid growth, having a preponderance of cells. There is little stroma, and this of a cellular character, while the alveoli are large.

The process occurs as nodules of different forms and sizes of a pale or pink color. On section the tumor is very juicy, which latter is of a milky character. The tumor is very vascular and frequently giving rise to hemorrhage. When caused by a fungoid growth they are called "*fungi hematodes.*"

Microscopical.—The tissue consists mainly of the large alveoli with the epithelial cells, which they contain. As before stated, the stroma is very delicate and of a cellular character, consequently the blood-vessels, which are poorly supported, rupture easily, leading to extravasation of blood into the alveoli. As to the cells themselves, we find that they multiply by indirect division of the nucleus, but that they vary in size and form, according to the location of the tumor. When occurring in the mammary glands, the cells are large, round or polygonal, and contain several nuclei.

Seat.—As a primary growth it usually affects the breast testes or mucous membranes. When occurring secondary to hard cancer, we find it involving more vascular organs.

Degenerations.—May be fatty, mucoid, colloid, cystic or pigmentary.

Nature.—Very malignant. It should not be mistaken for small round-celled sarcoma. Soft cancer occurs less commonly than does the hard, is generally secondary and found in internal organs, though primarily, in the mammæ or testes. Hard cancer usually affects thin and dry old people, and does not always shorten life. The lymph glands form a barrier, and it does not enter them for one or two years later; the process is confined to the glands for two to five years before giving metastasis; consequently in cases of cancer of the mammary glands it is of the greatest importance that the axillary glands should be removed.

Soft cancer does not show the different zones, is larger, softer and grows more rapidly than the hard cancer and resists all attempts of cicatrization. It grows in fat and soft women and usually kills inside of five years, giving metastasis to the lymphatic glands during the second year.

THE TELANGIECTATIC CANCER.—(Fungi Hematodes)— as mentioned with the soft cancer (of which it is a variety), has a highly developed vascular system, so great that oftentimes we find no other stroma than the vessels. It is of a dark red color, liable to excessive hemorrhage, pigmented with methemoglobin and frequently assumes large size.

Seat.—Found in stomach, ovary, mammæ, rectum and intestines.

Nature.—Is very malignant.

Degenerations.—Cystic.

Combination.—Sarcoma.

COLLOID CANCER.—*Synonym.* Alveolar, gelatiniform cancer. It resembles the hard cancer, and really is not a distinct cancer of itself.

Macroscopical.—It is lobulated, intersected by fibrous bands and of a soft, pulpy, gelatinous consistency, having a bad odor, growing peripherally and having a strong tendency to invade neighboring structures.

Microscopical.—The alveoli are more nearly round than in other cancer, while the spaces are filled with the yellow colloid material instead of epithelial cells. Occasionally the degeneration is only partial, in which case the protoplasm of the cells is encroached upon by the colloid mass. In some cases there may be a laminated appearance caused by the degenerative process. At the outside are seen alternate layers of fibrous and yellowish material. Inside of this is the colloid mass, in the centre of which are a few degenerated cells.

Nature.—Said to be malignant; does not give metastasis.

Seat.—Stomach, mammæ, ovary, intestines, and in the peritoneum when secondary.

Degenerations.—May be cystic.

CYLINDROMA.—Under this name we have a mixed tumor of a composition frequently seen in other growths, and which is probably a metamorphosis of an epithelioma involving the lymph vessels. It also resembles fibroma, when containing only a small amount of gelatinous matter; when containing a large amount it resembles colloid.

Seat.—It occurs about the jaw or orbit, generally returning, but not metastatic.

PAPILLOMA.—These tumors originate with the papillæ of the skin as a prototype. The connective tissue sends up papillæ, supplied with blood-vessels which terminate in a loop or fine network, the whole of which is enveloped by epithelium of a character varying with the location. When on the skin we often find a firm dense covering, while those affecting mucous membranes naturally have a thin and delicate covering, and are softer than those growing from the skin.

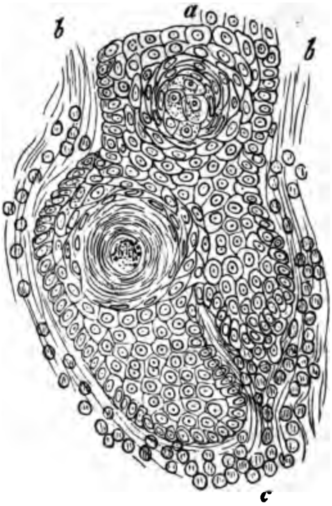

FIG. 28.—Section of a cylinder of epithelial cells, under a magnifying power of 500. *a*) The cylinder itself, with the characteristic stratification of its cells, a younger and an older pearly globule. (*b*.) The stroma, very rich in cells at (*c*.), and contributing directly to the enlargement by apposition of the cylinder.

They may grow singly, as in the wart, which is a fibroma, made, by its location, papillomatous, or there may be many of them, in which case it presents a cauliflower appearance, there being as a rule, a thin epithelial covering.

These combined under one covering become quite a large tumor. They sometimes become fungoid and highly vascular. They usually grow from a papilla due to some irritation, but often when there is no papilla they grow from connective tissue. They grow slowly, and with the exception of the multiple papilloma do not become very large.

Papilloma are hard and soft, according to location, the former growing from the skin and are harder and less vascular than the soft variety.

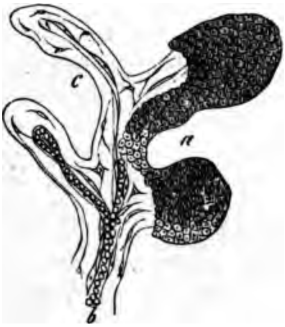

FIG. 29.—Cylindroma in the cortex of cerebellum.

Horns are often classed as papilloma, but are hardly such, inasmuch as they seem to grow from the sebaceous follicles, being the result of an excessive growth of the epithelium and sebaceous material. Under *Hard Papilloma* we find classified warts, venereal warts and condylomata, generally occurring on surfaces covered with squamous epithelium.

Nature.—They are benign, though they may ulcerate and cause hemorrhage.

Seat.—Anus, labia, and skin.

Under the heading of Soft Papilloma we find growths originating on mucous surfaces, which are soft and very vascular, having a more delicate covering than does the hard variety, hence more prone to ulceration and hemorrhage; they usually occur on surfaces covered by columnar epithelium, such as the stomach, intestines, rectum, vagina, uterus, bladder, tongue, larynx and nose.

The tumors should not be confounded with epithelioma when infecting the bladder and causing hemorrhage.

Nature.—It is benign, but may be disastrous through hemorrhage.

Similar growths of this class, though hardly serious enough to classify, are horns, corns, onychoma and ichthyosis.

ADENOMA.—A tumor deriving its type from glandular epithelium, resembling tubular or racemose glands, but not capable of performing the functions of the gland, and are usually located outside of the glands.

We find squamous or columnar epithelium lining the acini, of which cells there may be two or three layers in each acini. The lumen is plugged up by the excessive growth of epithelium, while the acini are joined together by connective tissue, in which the blood-vessels are imbedded.

The amount of connective tissue varies: when in large quantities, the growth is called adeno-fibroma; and varying in other constituents we have other mixed tumors.

We seldom find the adenoma in the mammæ.

Macroscopical.—We find a lobulated and encapsulated tumor resembling a hypertrophy, but differing from it in being entirely separated from the gland.

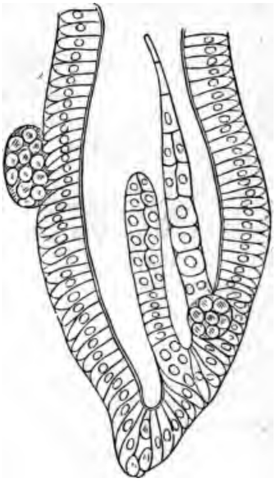

FIG. 30.—From an Adenoma of the Digestive Tract Copied after Klebs. (Handbook of Path. Anat., Fig. 4.)

Those growing from mucous membranes are soft, forming polyp, etc., but located elsewhere, as in the thyroid, we have a hard, firm, elastic tumor of a slow growth.

Seat.—Thyroid, prostate, parotid, testes, liver, nose, and rectum.

Nature.—Usually benign, though they recur.

It is often difficult to distinguish this tumor from cancer and sarcoma.

Degenerations.—Fatty, mucoid, colloid, and cystic.

Combinations. — Myxoma, fibroma, sarcoma, and carcinoma. Sarcoma and fibroma have considerable connective tissue, and generally are more easily diagnosed than the carcinoma, which differs from adenoma in not being of a spherical shape, nor encapsulated, as is adenoma.

In adenoma there is no umbilication nor retraction of the central zone, as in carcinoma.

In adenoma, with columnar cells, we find the latter resting on a basement membrane outside the alveoli; inside may be a free space.

In cylindrical epithelioma there are no spaces at the periphery between the connective tissue and cancer mass.

MYOMA.—This is a hypertrophy with new formation, accompanied by hyperplasia of the elements.

Myoma may be composed largely of striated muscle fibres, in which case it is termed—

(1.) *Rhabdo-myoma,* which is a rare tumor, and only found as a result of a higher development of sarcomatous tissues, in which the tissues are imperfectly developed and usually remain in an embryonic condition. We find striated and spindle shaped cells imbedded in young striated muscles, usually found in the kidney. It may be combined with sarcoma or carcinoma, in which case it might be found in other localities; it may become pigmented.

(2.) *Leio-myoma* is composed of smooth muscle fibres.

Macroscopical.—They may be small and round, or large and lobulated, encapsulated, multiple, and resemble fibroma (being firm and elastic), with which tumors it is usually combined, especially when growing from the uterine walls. This is of such frequent occurrence that the tumor is called "uterine fibroid."

Myo-fibroma or fibro-myoma are usually found in the uterus of sterile women or elderly negresses, more than half of which class are affected with the tumor.

Microscopical.—The tissues are arranged in concentric masses, while in the large tumors each lobule follows this concentration.

The blood-vessels supplying this new growth lie in fibrous bands, which pass between the lobules and radiate from the capsule. The muscle fibres formed by the overlapping of the spindle cells are found in interlacing bands.

Seat.—In the uterine wall the tumor may occupy three portions: (1.) Intramural; (2.) Submucous; (3.) Subserous.

The mural form is composed largely of connective tissue. Tumors located in the other two positions become polypoid, and are found to have pushed all the tissues out of place.

Degenerations.—Mucoid. Fatty, hemorrhagic, calcification.

NEUROMA.—True neuroma is seldom seen, growing as it generally does from the cerebro-spinal nerves, the structures of which it imitates. They are made up of nerve cells and fibrilli, while the false neuroma, which is merely a fibroma growing from a nerve, is made up of naked axis fibres. They may be multiple, but are usually single. They are more like small white nodules than tumors.

The neuroma are further divided into *fibrillar and ganglionic neuroma.* The former are subdivided into—

(1) Myelinic neuroma, medullated fibrillæ.

(2) Amylinic, non-medullated fibrillæ.

(3) Ganglionic neuroma is very rare, and usually congenital. The diagnosis is often concealed until the autopsy. They are probably misplaced masses of embryonic cells, and are usually combined with teratoma.

Neuroma are found on amputated nerve stumps, by many called "amputation neuroma;" most of which are fibroma, and although they may give rise to considerable pain, are usually benign.

Combinations.—Glioma. Fibroma. Myoma.

TERATOMA.—Are peculiar congenital combinations, comprising many of the tissues of the body, and usually due to faulty development in the fetus.

CYST.

The term is applied to any globular or circumscribed collection of fluid in an organ or tissue. "A cyst is a hollow tumor having an epithelial lining and containing a more or less fluid material." They are not true neoplasms. Cysts are divided into the following classes, according to their nature: Retention, exudation, extravasation, softening, parasitic and dermoid.

RETENTION CYST.—This cyst is caused by the retention of a normal secretion in the gland, the result of some obstruction in the natural outlet, due either to some mechanical means, as calculus, or to an inflammatory process, whereby the walls of the outlet are involved.

Retention cysts are divided in three classes:

Follicular cysts.—These are small and occur in the sebaceous follicles as comedo, wen and small cysts in the skin glands.

Mucous cysts.—Those in which there is retention of mucus and are seen in the mucous membrane of the cervix, uterus or nose.

Atheromatous cysts occur in larger glands.

EXTRAVASATION CYSTS.—These do not belong to a tumor class, but result usually from an extravasation of blood, or hemorrhage, and the subsequent absorption of the blood and extravasation of serum into the area. The sac is lined with epithelium. Such cysts are found in cases of apoplexy.

EXUDATION CYSTS are the result of an excessive secretion (generally serum) into cavities which have no outlet.

Under this heading we find hydrocele, hydrocephalus, ascites, hydrothorax, ganglia. Bursæ are physiological examples.

SOFTENING CYSTS may result from the localized degeneration and liquefaction of any swelling. They occur commonly in the brain as a result of softening processes, resulting from embolic processes.

DERMOID CYSTS are not true neoplasms. They are often congenital; and seem to be errors of development or due to invagination of skin or ova, arrested during development. They are cystic tumors, representing dermal structures and contain hair, teeth, nails, bones, etc. When they contain nervous matter they probably belong to the *teratoma* group. They may be superficial or deep.

PARASITIC CYSTS, as the name would indicate, are the result of some destructive process of parasitic origin, as hydatids.

OVARIAN CYSTS form primarily as retention, but later may become exudation cysts. They resemble adenoma, and have been termed adenoma of the peritoneum and ovary.

The tumors may become large and are surrounded by a fibrous capsule. The small cysts contain an albuminous and gelatinous material, while the larger ones contain a serous and watery fluid. There are many small cysts contained in the vascular connective tissue stroma. These cysts, which vary in shape and size, may be subdivided by papilliform projections, which subdivide the primary cysts.

THE BLOOD.

Unlike other media, the blood is dependent upon other parts for its formation, etc., hence when we study the changes occurring, we are studying conditions of other organs which affect the blood.

The source of the blood may be found in the marrow of bones, spleen and lymphatic glands, while it may also be destroyed in the spleen or liver.

DYSCRASIA.—A permament condition of the blood usually of a plethoric nature.

ANEMIA.—A diminution of the red corpuscles and of the albuminoid compounds. The shape of the cells, as well as the hemoglobin compounds, are changed. The process being a poverty in both quantity and quality, including senile changes.

Anemia causes hemorrhage, diseases of the blood-making apparatus, obstruction to the circulation, general fatty degeneration, or even necrosis.

Anemia may be caused by hemorrhage, starvation, malnutrition and wasting conditions. It may also be the result of the action of poisons upon the system.

Death may occur as a result of anemia of the brain or fatty degeneration of the heart, which takes place rapidly after copious hemorrhage.

OLIGEMIA.—A poverty in quantity of the blood, due to poor nourishment, hemorrhage, or transfusion. They are simply transitory conditions.

OLIGOCYTHEMIA.—A poverty in quality of the blood, due to malnutrition, hemorrhage, etc. There is a diminution in the number of red corpuscles, the shape of which is changed.

PERNICIOUS ANEMIA.—A condition resembling both chlorosis and leukemia, there being the characteristic changes in the blood of chlorosis, while there is an increase in the number of white blood cells and the changes in the bone marrow, characteristic of leukemia. Associated with these changes there may be fatty degeneration of the walls of the arteries and heart, as well as thrombosis of the pulmonary artery.

ANHYDREMIA.—A condition associated with excessive serous discharges, in which the blood becomes thickened, due to the removal of its fluid constituents and a decreased quantity of plasma.

HYDREMIA.—A condition, in which we find the watery elements of the blood greatly in predominance. This relative excess of watery elements may be a hyperplasia, or may be caused by a decrease in the proportion of solid elements. It is sometimes caused by hemorrhage; we also find it associated with Bright's disease and most cases of polyuria. There are present nucleated red corpuscles and microcytes, as well as an increased amount of plasma.

CHLOROSIS (Green Sickness). A diminution in the whole solids of the blood, especially of the hemoglobin, with an increase in the watery constituents. The blood is pale, as is also the skin and organs, while the mucous membranes are greenish; hence the synonym.

There is an insufficient blood-vessel apparatus.

The nervous system is probably at fault.

LEUKEMIA, or **LEUCOCYTHEMIA (Addison's Disease)** may be of **splenic, lymphatic** or **myelogenic** origin, and is usually associated with hyperplastic changes in the hematoplastic viscera. It is a condition in which we find an enormous increase in the white blood corpuscles, decrease in the proportion of the red cells, associated with anemia and diseases of the lymphatic system, portions of which are often enlarged, and usually the result of splenic fever. We find a change in the bone marrow, which becomes greenish and fetal, while the liver and spleen are greatly enlarged, as is the lymphatic system generally.

There may be ecchymoses of the mucous and serous membranes, as well as hemorrhages, which occur upon the slightest provocation. Associated with the condition there is frequently fatty degeneration of the heart or kidney.

In leukemia, as in pernicious anemia, we find a pathological corpuscle, nucleated and apparently an intermediate development between the red and white corpuscle; it is called the corpuscle of Eichorst. In leukemia we find hyposanthin, gelatin, lactic, formic and phosphoric acids.

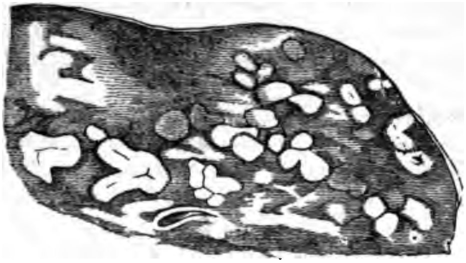

FIG. 31.—The cut surface of a spleen in the second stage of leukemic swelling. Enlargement of the malpighian corpuscles. Pigmented atrophy of the pulp.

Prognosis is bad; usually fatal in two or three years, dependent largely upon the degree and the complications.

PSEUDO-LEUKEMIA (Hodgkin's Disease).—A condition in which we find a general lymphatic enlargement without leukemia—*i. e.*, there is no marked increase in the quantity of leucocytes.

It is usually dependent upon lymphadenoma, or some serious constitutional defect, and yet there is rarely any marked change in the blood.

The glands, which become involved in rotation, enlarge, the walls break down, and the neighboring glands become a lobulated mass.

ADDISON'S DISEASE.—The name implies a condition characterized by a peculiar "bronzed" condition of the skin; certain changes in the suprarenal capsules, as well as a diminution in the number of the red blood cells.

The pigmentation seems to affect exposed portions of the body, such as the face, back of hands, neck, etc. It also appears later about the genitals, thighs, umbilicus, and finally becomes general, even invading the mucous membranes of the mouth.

It appears to be a decided constitutional disease of the asthenic type, due probably to a chronic inflammatory condition of the suprarenal capsule. Associated with the condition, the following organs are involved:

In the heart there may be fatty degeneration, while there may be pigmentation of the gray matter of the brain, meningitis and distension of the ventricles.

The suprarenal capsules are enlarged, hard and nodular, containing cheesy masses, around which are gray zones of semi-translucent granulation and connective tissue. The cheesy masses may become calcified or softened and degenerated.

Hyperemia may be *active* or *passive.*

ACTIVE HYPEREMIA, sometimes called arterial hyperemia, is due to an increased amount of blood in a part.

The process may be: (1.) *Idiopathic*, when the disturbances are in the hyperemic area. (2.) *Collateral.* In this form the blood-vessels of the hyperemic area are healthy, but over-distended, as a result of blood-vessel disturbances and consequent anemia in other tissues.

Cause.—Anatomical changes in the blood-vessel walls, such as fatty degeneration, resulting from inflammation or infective fevers, the latter often leading to changes produced by micro-organisms.

External sources: heat, trauma, etc.

Nervous causes may be the result of vaso-motor influences, either dilatation or constriction. Nervous hyperemia are usually reflex conditions.

Macroscopical.—The tissue is swollen, painful, red in color, and of an increased temperature.

If continued for any length of time, inflammation, hypertrophy or necrosis may result.

In the early stages the functions of the parts are increased.

PASSIVE HYPEREMIA.—Synonyms. Venous hyperemia, stasis. In this condition the circulation is impeded, usually caused by complications of the lungs or valvular conditions of the heart, or locally by diseased conditions of the veins, obstruction by thrombi, or such external causes as pressure, etc., though it is very seldom that hyperemia is caused by a local condition because of the collateral circulation which may be so quickly established.

Macroscopical.—The tissues are bluish, swollen and painful, of a low temperature and sometimes edematous, as usually the dependent parts are involved.

Hyperemia may lead to fatty degeneration, cloudy swelling, atrophy, necrosis, gangrene, etc. After death an active hyperemia becomes pale because of the contractions of the vessels.

Passive hyperemia becomes light red in color.

True post-mortem congestion is of a reddish or purplish color, due to the constriction of the arteries after death.

This condition may be distinguished from previous congestions by opening the area, when the blood flows out, which in extravasation does not occur, as the blood coagulates as soon as it extravasates. The color disappears upon pressure and further, in hypostatic congestion there are no swellings above the surface.

ISCHEMIA.—(Local anemia).—May be as in the hyperemia, *idiopathic* or *collateral*, and may be caused by mechanical pressure, diseases of the blood-vessel walls, arterial resistance, thrombi or nervous influences, as anemic patches.

THROMBOSIS.—It is the coagulation of blood in the heart or vessels during life. The coagulum being called a *thrombus.*

In order that the blood may be kept fluid it is necessary that it should be constantly in motion; anything which causes retardation produces thrombosis, which is always secondary to some other lesion.

Thrombosis is caused by changes in blood-vessel walls, impeded flow of blood, changes in the blood (present or previous clots), or a breach in continuity of the walls which might result from inflammatory conditions, heart disease, hemorrhages, pregnancy, starvation, etc.

As soon as the circulation is impeded the corpuscles become imbedded in the fibrin and coagulation results.

Thrombi, the shape of which changes from time to time, may be (1) *obstructing* when filling the whole lumen; (2) *parietal* when lying on the side of the wall; (3) *valvular* when partially filling the lumen; (4) *channeled*, those having perforations or channels through the clot. The appearance, as to color, depends upon the number of red corpuscles present.

"*Current-jelly*" clots contain many red corpuscles; are red and soft.

"*Chicken-fat*" clots contain about equal parts of red and white corpuscles.

White clots consist of white corpuscles and fibrin; clots may be stratified, resulting from the deposition of different cells, which may be influenced by changes occurring in the blood current, etc.

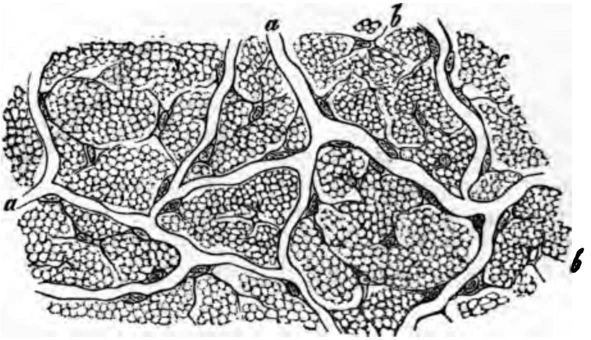

FIG. 32.—Cross section through a thrombus by ligation of the crural artery, thirty-seven days old; hardened in alcohol, treated with dilute acetic acid, and then with a little ammonia. (*a*) Capillaries. (*b*) The cell-net of the colorless blood-corpuscles. In the basis-substance the contours of the red blood-corpuscles.

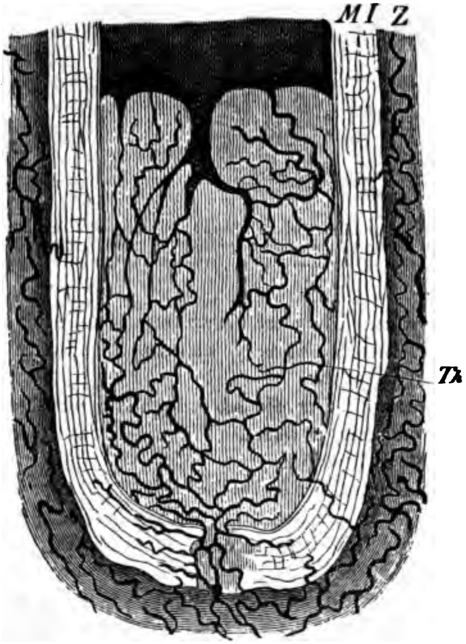

FIG. 33.—Longitudinal section of the ligated end of crural artery of a dog, fifty days after ligation. Injected by O. Weber. *Th*. Thrombus. *MI*. Middle tunic of vessel. *Z*. Cellular tissue tunic.

Clots in general may be *lateral* or *obstructing.*

Lateral clots form on the side of a vessel. They are laminated, due to their slow formation and to a deposition of the obstructing materials in layers; for example, first we have a layer of red corpuscles, then a layer of white, etc. They are sometimes called "*medical*" *clots;* occur in veins and are caused by heart disease, atheroma, aneurism or other blood-vessel disease. They neither adhere to the walls nor completely fill the vessel, and are always softened.

Obstructing or *Surgical clots* are non-laminated, uniform in structure, form rapidly and are usually caused by ligation or injuries occurring in arteries. They are always organized and adhere to the vessel walls. A lateral clot may become an obstructing clot and vice versa.

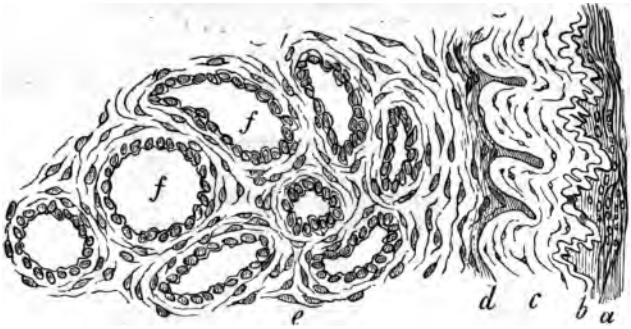

FIG. 34.—From the cross section of an arterial thrombus of three months. (*a*) Media, only the innermost layers (*b*) Boundary lamella of the media and intima. (*c*) Intima. (*d*) Boundary of intima towards the thrombus. (*e*) Thrombus. (*f*) Lumina of vessels. Distinct epithelium.

Their shape cannot be predicted, though the non-laminated which form quickly are usually uniform. These occur in syphilitic cases or may be the result of ligation.

Both clots have a pointed extremity which is always facing the current of blood. Clots are usually of a conical shape and undergo secondary changes, and sooner or later terminate in organization, softening or calcification.

In organization we have many theories offered; but probably the correct one is based upon the idea that the old clot has nothing to do with the formation; it disappears and is supplanted by a new one, which is formed by the proliferation of the cells of the intima with the aid of the white corpuscles.

The vessels spring from the mother vessels and the blood supply from the vasa vasorum.

In organization, we have first, contraction of the clot, then discoloration and finally it becomes a hard, fibrous cord.

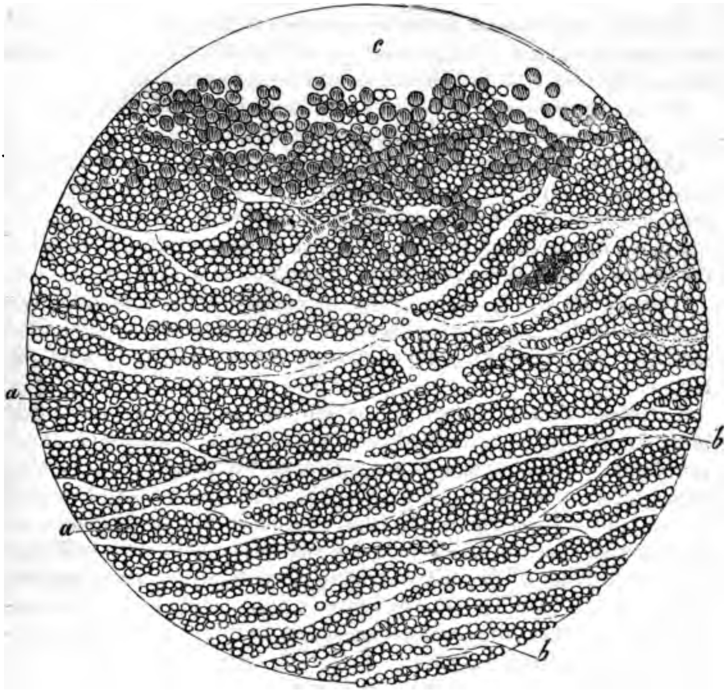

FIG. 35.—From the cross section of a softening thrombus. (*a*) Layers of blood-clot. (*b*) Colorless layers, consisting of firmly united white blood corpuscles. (*c*) Cavity of softening.

The further steps in the process resemble ordinary organization processes with their fibrillation, cicatrization, etc.

The whole process requires for completion from two weeks to many months.

If a clot becomes infectious or undergoes cavernous change it may become dangerous. Softening usually occurs in laminated clots, and may be of two varieties: Red softening, which occurs in recent clots, or yellow softening, which infects old clots. As a result of the process there is a mucoid mass resembling purulent pus, but it is not a superaddition. In both the red and yellow softening the process begins in the center of the mass.

Softening is caused by suppuration or liquefaction necrosis.

Suppuration is caused by bacteria, hence portions may be carried into the circulation and become distributed throughout the body, where they may establish similar destructive processes.

Thus thrombi may be specific or mechanical. In calcification of a clot, vein stones (sometimes called phleboliths) are formed.

EMBOLISM.—Signifies the arrest of a foreign, solid substance (called *embolus*) in a vessel too small to allow its passage. It is usually formed by thrombi, coming from the heart.

Emboli in the veins are usually carried to the lungs, while those of the arteries may lodge in the brain, causing coma.

Some vessels are more prone to embolism than others. For instance, the left carotid and illiac are more commonly affected than the right, while the right pulmonary suffers more frequently than the left.

Embolism finally causes obstruction, and we have hemorrhagic infarction resulting. This, however, does not occur when the collateral circulation is good. Emboli always follow "bee lines" when passing through the circulation. Thrombi of the right side causes embolism of the same side; the latter are usually found in the small arteries or end arteries, which have only one vein and consequently poor collateral communications. They may originate in veins and lodge in arteries, and when lodging in the fourth ventricle of the brain or in the coronary arteries of the heart, immediate death results. It may also produce coma or paralysis.

Embolism is invariably followed by thrombi, both in front of and behind the embolus, which becomes surrounded by a hyperemic area.

Emboli are *mechanical* or non-infectious when the result of a particle of thrombi, air, valvular vegetations, etc., and lead to hemorrhagic infarction.

They are *infectious* when caused by gangrenous products, such as pus, bacteria, etc. They are carried by the emboli from the primary *foci and lead to* abscesses.

HEMORRHAGIC INFARCTION.—This is an extravasation of blood into the tissues. The blood coming from vessels beyond an obstruction, and results when an embolus becomes lodged in a terminal artery, where the collateral and capillary circulation is poor. The walls become weakened and burst, giving rise to a large discolored area, in which the tissues break down.

An infective embolus occurs generally in veins of the buttock, originating usually from infective material and causes intense inflammation, which usually terminates in a metastatic abscess, occurring at the centre or periphery of an organ.

A slight absorption of septic material causes a condition known as surgical fever, which may progress to septicemia or finally pyemia, in which case there may be emboli and abscesses present, also a tendency to suppuration.

Small pieces of lung tissue (the abscess is usually seated in the lung) may be carried into the heart, leading to the formation of small abscesses and having a tendency to cause stagnation of blood throughout the system. Hemorrhagic infarctions usually assume a wedge-shape, the base being toward the periphery of the organ, because the blood oozes in the area of the terminal blood-vessels, which are of a conical arrangement. The infarction may become absorbed and undergo resolution; may become a cyst; may organize and form scar tissue, or may lead to inflammatory changes and abscesses.

HEMORRHAGE.—May be arterial, venous, capillary or possibly parenchymatous, being a combination of the three varieties.

Hemorrhage may occur from the free surface, either externally or internally.

Externally there may be epistaxis, hematemesis, hemoptysis, hematuria and uterine hemorrhages.

Internally there may be hematocele, hemothorax, hemopericardium, hemoperitoneum.

Hemorrhages into the tissues may be extravasations and ecchymoses, or they may form the artificial cavities as hematoma.

Hemorrhages may occur as diapedesis, or they may be copious, as in rupture of a vessel.

Cause.—Traumatism, excessive blood pressure, heart disease or whooping cough, etc., changes in walls of vessels, as apoplexy, etc., nervous influences as seen in hemorrhage of the lungs following cerebral hemorrhage. Hemorrhage may terminate by the formation of a clot, coagulation necrosis, and subsequent organization. When hemorrhage occurs in a serous cavity it is rapidly absorbed, but when occurring in the tissue it is slowly absorbed and leaves a discoloration, and leads to liquefaction and cyst formation, occasionally to cicatrization.

HEMOPHILIA is more of a tendency than disease, in which bleeding occurs upon the slightest provocation or even spontaneously. It is a congenital condition, terminating fatally when once established.

BLOOD-VESSELS.

NORMAL HISTOLOGY.—Capillaries have but one coat which corresponds to the inner coat of the veins and arteries, being continuous with the intima of the larger vessels, and also continuous with the endocardium.

The intima has no blood-vessels of its own; it is avascular and lined with endothelial cells.

The media, composed of muscular and elastic fibres which increase in quantity with the size of the vessel, is present in both arteries and veins. In the former it is chiefly circular, giving them the power of contraction; in the veins we find the fibres arranged longitudinally.

The adventitia is the outer coat, composed of connective tissue, which gradually shades off into the general connective tissue of the body; hence the outside coat of an artery wall has no definite limit, though the adventitia plays a most important part in furnishing connective tissue, in case of cirrhosis.

In the very large arteries there is a fourth coat between the intima and muscle coat, which is sometimes called the glass-like membrane.

DISEASES OF THE BLOOD-VESSELS.

These, like other agents or tissues, are subject to acute and chronic inflammation; the former is caused by mechanical injury, septic emboli or thrombi, and usually occurs between the intima and media; occurring in the adventitia we have a condition sometimes called periphlebitis or periarteritis. The intima being avascular, the process, when occurring behind the intima, is nourished by inhibition.

Chronic inflammation usually occurs in the intima, giving us a condition known as chronic endarteritis, as a result of acute inflammation, mechanical strain, syphilis or old age.

Simple inflammatory processes occur more commonly in arteries than in veins.

DISEASES OF THE ARTERIES.

ATROPHY may occur, as in other tissues, as the result of wasting conditions or as the result of atrophy in a part in which the vessel is situated. The middle coat is usually involved the more extensively. The amputation of a part causes atrophy of the vessels in the remaining stump.

HYPERTROPHY is caused by excessive pressure, and is seen in the establishment of a collateral circulation, in which the vessels become distended and hypertrophied. The vessels may be subjected to albuminoid and calcareous infiltration and fatty or hyaline degeneration.

ACUTE ARTERITIS is found usually in the aorta, but may occur in smaller vessels, especially in those near an injury.

Macroscopical.—Patches are seen upon the inner surfaces of a soft gelatinous-like material, having a pink or yellowish color. The outer surface is inflamed, associated with which is the formation of a gelatinous material similar to that described above, proving that acute endarteritis is accompanied by periarteritis.

Microscopical.—When there is much thickening the cells of the deep layers of the intima are seen in abundance undergoing rapid proliferation, and separated only by a delicate laminated tissue. As the process advances the cells of the adventitia increase in number, even to the extent of resembling granulation tissue. As the process extends there is a tendency toward chronicity and the formation of fibrous tissue, which is especially marked in the coronary arteries.

CHRONIC ENDARTERITIS.—Atheroma, endarteritis deformans. A degenerative condition associated with inflammation.

Macroscopical.—Patches of opaque, firm and hard tissues are scattered along the vessels usually confined to one side, causing thickness of one side of the vessel wall and an irregularity of the lumen.

Microscopical.—The changes occur almost entirely within the internal elastic lamina, located within the muscular layer. The cells are flattened and the lamina swollen, while there is considerable granular material present; we find only a portion of the circumference of the wall involved. The process commences in a swelling and proliferation of sub-endothelial cells followed by swelling of the fibrous elements;

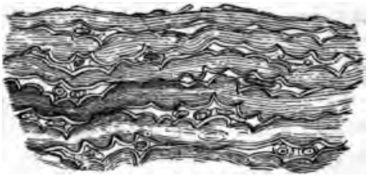

FIG. 36.—From section of the tunica intima of aorta.

these may become fatty, degenerated or calcified, forming atheromatous plates. Degeneration may cause breaking down of the elements, and possibly rupture into the vessels, the result of the atheromatous ulcer.

Cause.—Old age, alcoholism, syphilis, rheumatism, etc.

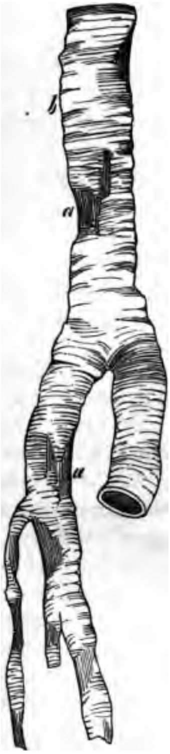

FIG. 37.—Calcification of the media of the femoral artery, together with its ramifications. Not magnified.

ATHEROMA usually involves the intima of the medium-sized vessels, giving rise to a calcareous deposit around the openings into the larger vessels, especially about the aortic arch. When there exists a degeneration of the lining membrane we have an atheromatous ulcer formed, the diseased tissues being washed away by the blood stream. The atheromatous pulp, which is the result of fatty degeneration and the softening of the cells and intercellular substance, is composed of cholesterine and fatty material, the result of liquefaction and fatty degeneration. This mass may ultimately become calcified and form a calcareous plate Atheromatous abscesses are the result of a chronic inflammation, in which there is formed a yellowish pulpy substance as a consequence of a degenerative process which involves the intima. The abscess finally empties; the endothelium drops back and the lumen is restored, but usually with the formation of folliculi.

We also have, in connection with the atheromatous process, a calcification of the intima which may lead to perforation. These concretions of lime become loosened and give rise to emboli, which latter may also be caused by the mixture of the atheromatous pulp with the blood.

We have two other conditions which are not due to inflammatory processes:

(1) Simple degeneration occurring in the intima,

giving rise to a superficial fatty ulcer. The blood presses upon this and causes a rupture, forming a vacuum, which is the beginning of a dissecting aneurism. These changes are found in vessels of medium size, such as those of the brain.

(2) Calcification of the middle coat occurs in small vessels, as the radials or temporals.

These two processes hardly come under the head of atheroma, since they are not inflammatory; while atheroma is a chronic metamorphosis occurring in connection with chronic endarteritis, it is always considered an inflammation and not a calcification.

ENDARTERITIS OBLITERANS.—An acute inflammatory process affecting the intima and the endothelial linings of the arteries. This condition occurs frequently as a result of syphilis, inflammation and healing wounds of lungs (as quarrymen's phthisis) and in the kidney vessels in nephritis. This form of endarteritis is commonly seen in syphilitic conditions, and is said to be the determining cause of the caseation of gumma.

It may involve the small vessels in any part of the body, but is usually found in the cerebral arteries as small nodular thickenings, while the lumen is contracted and irregular in shape

While there is considerable thickening of the intima, there may be an infiltration of cellular elements into the adventitia.

SYPHILITIC ARTERITIS.—A common condition which may lead to partial or complete occlusion of the lumen of the vessel, by a thickening of the intima, or all the coats of the vessel may be involved.

There is a rapid proliferation of endothelial cells without a tendency toward degeneration. On the other hand there may be organization and formation of fibrous tissue.

TUBERCULAR ARTERITIS.—The walls of the arteries, especially the small ones, are much thickened. The process is merely an extension from tuberculous neighboring tissues, beginning in the adventitia and invading the tissues inward. There may be early coagulation and cheesy necrosis, while pulmonary hemorrhages are caused by aneurismal dilatations.

The results of arteritis may vary greatly, according to the size and situation of the affected vessel and the extent of the lesion. There may be valvular heart disease, hypertrophy of the left ventricle, rupture of vessels of the brain, thrombi, aneurism, gangrene, etc.

DISEASES OF THE VEINS.

PHLEBITIS.—Conditions affecting the veins usually result from inflammatory conditions.

ACUTE PHLEBITIS.—A condition in which the walls of the brain are infiltrated with cellular tissue. Small granulations appear in the intima, and later thrombosis, which may lead to emboli of the lungs. This process may terminate in organization, or when micro-organisms are present, there may be suppuration, leading to suppurative phlebitis and linear abscesses. The process is caused by septic emboli, syphilis, thrombosis, injury, etc.

DILATATIONS AND ANEURISM.

VARIX.—The superficial veins, especially those of the mucous membranes, and of the lower extremities, become tortuous and distended, so that irregular distensions and calcification may occur. The valves are destroyed by the distensions of the intima, while the veins themselves are surrounded by a mass of connective tissue. There may be fatty degeneration, calcification, and sclerosis.

Varix may lead to (1) hemorrhage; (2) inflammatory processes in the walls or contiguous structures, the result of stasis, and having a tendency to become septic and suppurate. (3.) Chronic or varicose ulcers may result, occurring usually upon the legs, of a dark purple color and having thickened edges and base.

ANEURISM is probably a chronic inflammatory condition associated with permanent dilatation in an artery, the causes of which are (1) *predisposing* syphilis, alcoholism, rheumatism, etc. (2.) *Exciting* hypertrophy of heart, strains, paralysis of supplying nerves, thrombosis, atheroma, and commonly the result of endarteritis. Aneurisms may be true or false. **True aneurism** is one in which all the coats of the vessel are primarily involved in the process. This condition, however, usually results in the production of false aneurism, for the adventitia is, as a rule, the only coat which resists the progress of the process for any length of time.

The **false aneurism** is one in which, as has been inferred from the beginning, the two inner coats have been ruptured.

False aneurisms are either (1) *dissecting*, when the blood burrows between the coats and may return to the original canal; or (2) *traumatic*, when the cause, as the name indicates, is some injury. The traumatic variety is further subdivided into those caused by venesection, which leads to a vascular sac or hematoma; or those classed as aneurismal varix, a sac between a vein and an artery.

Dissecting aneurisms occur in the aorta and are due to strains. The intima ruptures, allowing the blood to dissect between the media and adventitia, or occasionally it may divide the media into two layers. We find upon close inspection that primarily the intima dilates without becoming thinner, but is soon destroyed through the action of the atheromatous change which has previously occurred.

The media simply stretches, the fibres stretch, yielding to the pressure, and perforation results.

The adventitia, which becomes thickened through hypertrophy, holds out for a long time, but finally succumbs, when the aneurism ruptures and the surrounding tissues act as the walls, which are also short-lived, as the aneurism "goes on forever," even to perforating bony structures, such as the vertebra and ribs.

We often find laminated clots in connection with the aneurism, but as they seldom organize, they are of no benefit to the aneurism.

As to the forms; aneurism may be:

Cylindrical.—Consisting of a uniform swelling of all the coats of the vessel and forming a cylindrical swelling.

Fusiform.—An exaggerated form of the above, giving more of an oval appearance.

Saccular.—Usually a pouch attached to one side of an artery.

Invaginated.—Resembles the above form, save that there is a pouch on each side of the artery, and the sides of this pouch are hollowed out.

ANASTOMOTIC.—As the name indicates, is an anastomosis.

When simulating varicose veins, aneurisms usually occur in the temporal artery.

Miliary or multiple aneurisms usually appear in the brain.

VARICOSE ANEURISM.—The result of the rupture of a previous aneurism, false or true, into a vein, which becomes the wall of the aneurism.

ANEURISMAL VARIX.—The result of a communication between an artery and a vein, when the blood passes from the former to the latter and causes it to dilate and hypertrophy. There is no pre-existing aneurism as in varicose aneurism.

ANEURISMS are usually located in the arch of the aorta, although they also occur in the popliteal and femoral arteries.

There are six points on the arch, which are common seats of rupture above the valves. (1.) Rupture into pericardium. (2.) Ruptures at junction of the two upper sternal bones. (3) Rupture between innominate and carotid, flows into the right lung. (4.) At apex, flows into trachea. (5.) Descending portion of arch, flows toward the spine. (6.) Near the lower end, flows into the left lung.

In the veins we seldom have dilatations.

There is never chronic phlebitis nor atheroma, but those slight dilations which do occur, are due to the excess of the intervascular venous pressure over the atmospheric.

HEMORRHOIDS.—Piles are tit-like projections of a spongy consistency, composed of dilated veins, due to straining when at stool.

There may also be dilatations at the neck of the bladder. There may be dilatations in the veins in connection with pregnancy (occurring in the lower extremities) or tumors, which are like most dilatations in varicose veins.

Dilatations in the veins of the spermatic plexus occur frequently, giving rise to varicocele. We also find "Caput medusa," navel or umbilical dilatation, due to distention of the vessels about the umbilicus.

With the dilatation of veins there is increase of connective tissue. We also find clots formed, which may become calcified, "venous stones" resulting.

HEART.

HISTOLOGY.—The walls of the heart correspond to the walls of the blood-vessels. The endocardium to the intima, although the former is more delicate than the latter and contains a few blood-vessels, which are more abundant in the valves. The valves are reduplications of the endocardium and consequently consist of two layers, between which we find a small amount of vascular connective tissue. We find that the valves do not exactly fit the aperture, but overlap a little. We also find that disease of the valves starts at the point to which the valve overlaps. In the aorta, the corpora aurantii being the favorite seat of disease.

The pericardium, the outer covering of the heart, is a serous sac subject to the same pathological conditions as is any other serous sac.

The muscular walls of the heart are composed of striated fibres which anastomose with each other and have a spiral arrangement.

The blood supply of the heart muscle is derived from the coronary *arteries.*

The human heart, in health, averages about nine ounces in weight. The male about ten ounces, while the female heart averages about eight ounces.

The circumference in both sexes is a trifle over nine inches. The wall of the left ventricle being slightly over one-half inch thick. The right about one-sixth in thickness, while the septum is less than one-half inch thick.

Functionally the heart is merely a pump. Of conditions affecting the organ we have such congenital abnormalities as absence of heart, too small a heart, absence of septum (auricular or ventricular), open foramen ovale, fenestrated valves, displacements or anomalous arrangements of vessels or valves.

The pathological conditions are:

HYPERTROPHY, which may be of several forms. Hypertrophy with diminished cavity is called concentric hypertrophy, while hypertrophy with enlarged cavity is called eccentric hypertrophy.

There are also degrees of these conditions, all of which commonly affect the left side of the heart.

Hypertrophy is caused by external pressure or internal adhesions or disturbances in the tissues or circulation, as atheroma, thrombosis, etc.

Disturbances in the pulmonary circulation leads to right-sided diseases.

ATROPHY.—May occur as the result of senile decay, inanition, marasmus, or it may be the result of pericardial adhesions.

BROWN ATROPHY.—Pigmentary infiltration. When this condition is found associated with atrophy, the heart is smaller and the walls thinner than normal, while the color is of a dark brown hue. The coronary arteries are tortuous and the cavities contracted.

If there is no fatty degeneration present the tissues may be firm, tough and even brittle; but when fatty degeneration exists the parts are soft and friable, and there may be light spots upon the dark tissues.

When associated with hypertrophy the tissues are firm and not so dark in color.

Microscopical.—The fibres are thinner than normal and broken, while dark spots of pigmentation may be seen in and around the muscle corpuscle.

The pigment is probably a form of hemoglobin, but whether that previously existing (myosin) or some new form from the blood is undecided.

FATTY INFILTRATION.—This condition should be distinguished from fatty degeneration of the muscular walls. In fatty infiltration there is increase in the amount of epicardial fat, later the fat extends into the muscular walls, between the bands of fibres.

Infiltration and fatty degeneration may be associated conditions, as it is seen in cases where the invading fatty tissue presses upon the muscular fibres and causes their degeneration. The fatty heart is larger than normal, due to the increase in the amount of subpericardial fat.

Microscopical.—The connective tissue cells as well as the epicardial tissues are infiltrated and distended with fat, and appear like normal adipose tissue.

The globules have a double outline and stain black with osmic acid, while the nucleus, which is situated at one angle of the cell, stains green or pink.

CLOUDY SWELLING.—This is probably the result of myocarditis, it may be the initial step of a fatty degeneration.

It may occur as the result of high temperature arising in connection with specific or other fevers.

Macroscopical.—The tissues are softened, friable and of a gray color.

Microscopical.—The fibres are opaque, while the spaces between them are smaller than in the normal heart.

FATTY DEGENERATION.—Usually follows cloudy swelling.

Macroscopical.—The heart is dilated, of a pale color, which is not equally diffused, but appears in patches, giving a striated, yellowish appearance. Occasionally small hemorrhages are present beneath the epicardium, due to septic or mineral poisons.

Microscopical.—Very little change is noticed save that in some cases, especially those arising from metallic poisons, the fibres are enlarged, leading to a narrowing of the spaces between them.

Granules and globules are sometimes seen at the poles of the muscle cells; from this point these granules finally involve the whole cell until the fibre resembles rows of these granules and globules. These resemble cloudy swelling, but in the latter the granules and globules are smaller and are not stained black with osmic acid.

Cause.—(1) Metallic poisons as phosphorus, arsenic, iodoform, chloroform, etc. (2) Febrile or septic conditions causing cloudy *swelling, and later leading* to fatty degeneration, which may cause sudden death. Such conditions are diphtheria, typhoid, malaria, scarlatina. (3) Exhausting conditions, anemia, phthisis, etc. (4) Local disturbances, as of valvular troubles.

MYOCARDITIS.—An inflammatory condition of the heart muscle, which may be acute or chronic, and may occur as a primary or secondary condition. It occurs usually extending from the endo- or epi-cardial surfaces into the muscle proper, or along the connective tissue which supports the muscular structures. The fibres are swollen and closely packed together.

CHRONIC INTERSTITIAL or SCLEROTIC MYOCARDITIS.—This is an interstitial inflammatory condition affecting the left side of the heart. The tissues are firm and hard, the result of pressure exerted by fibrous bands.

There is a proliferation of the intermuscular connective tissue cells resulting in the formation of new connective tissue and leading to fibroid degeneration. The process is secondary to endocarditis and pericarditis, and leads to the formation of cavities of the heart.

SUPPURATIVE MYOCARDITIS or ABSCESS.—This process results from an extension of an inflammatory process from the endo- or peri-cardium or from septic emboli of the coronary arteries.

The process may be diffuse, in which case the walls of the heart become filled with pus, or it may be circumscribed, which is more common and leads to abscess formation. They occur with infectious or septic conditions.

The abscess, which contains pus, bacteria and broken-down muscle tissue, may open into the pericardium and cause a purulent pericarditis, or into the heart cavity, leading to thrombi of the heart; emboli in any part of the body or the heart wall may rupture, having become weakened by the abscess.

ENDOCARDITIS.—May be acute, ulcerative and chronic.

ACUTE ENDOCARDITIS.—**Synonym.**—Valvulitis, verrucose or warty endocarditis. As the name indicates, of the valvular portion of the endocardium, usually of the left side, except such cases as occur during fetal life or in connection with septic endocarditis. The former usually affects the right side, while the latter affects any part of the endocardium. The first product of this inflammatory process is hyperemia; later there are formed vegetations, usually appearing on the upper surfaces of the valves. These vegetations are brittle and break up readily, often giving rise to embolism. In the case of involvement of the mitral or aortic valves, we find the inflammatory process beginning about one-half inch back from the edge, the point to which the leaflet overlaps on the auricular portion of the mitral, or the ventricular portion of the aortic.

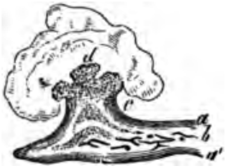

FIG. 38.—Acute endocarditis. Section through a flap of the inflamed mitral valve. (*a*) Upper. (a^1) Lower lamella of endocardium. (*b*) Middle layer whose vessels are hyperæmic. (*c*) The efflorescence of the upper lamella. (*d*) Fibrinous deposition.

The mitral valve is most commonly involved with the aortic, tricuspid and pulmonary in the order mentioned.

As a cause for this condition, we find acute articular rheumatism playing a most important part, while typhus, blood diseases, septicemia, scarlatina, syphilis, alcoholism, gout, kidney troubles, etc., contribute their share.

Macroscopical.—We find vegetations upon the valves, developing from the connective tissues between the lamellæ, with the aid of the endothelial cells and the products of the inflammatory processes; these verrucose or warty growths sometimes assume a fungoid appearance, due to the deposition of fibrin or blood clots, which, as above stated, may be readily broken up and carried away, giving rise in many cases to emboli or, when lodged in the brain, to paralysis. On the valve the spot is marked by an endocardial ulcer, which may perforate the lamellæ and leads to insufficiency. This perforation should not be confounded with fenestration, which is congenital. There may *be perforation of* both lamellæ and subsequent destruction of the

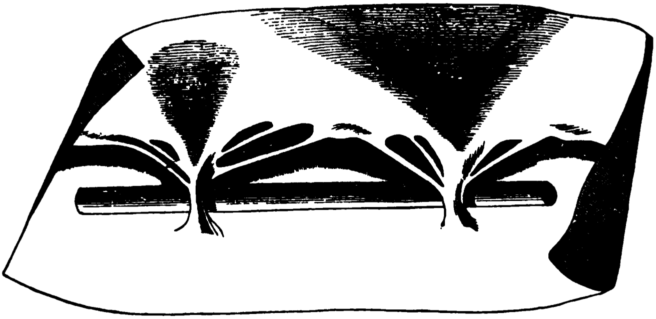
FIG. 39.—Fenestrated semilunar valve of pulmonary artery. Natural size.

valve, or the blood may flow between two lamellæ, forming a sac and giving rise to the condition known as acute valvular aneurism.

ACUTE ULCERATIVE ENDOCARDITIS.—This condition is considered by many as acute endocarditis; but it seems to be a process of a more severe nature, being usually of a septic character and caused frequently by septic material.

The process follows practically the same course as the acute endocarditis, but seems to reach its zenith much more quickly, and is characterized by being much more destructive, while fragments from the process give rise to much more rapid and extensive complications than do emboli from the acute form.

The process may involve any part of the tissue, but usually leads to multiple abscess of the myocardium.

Microscopical.—The ulcer and tissues are infiltrated with round cells, while degenerative changes occur which lead to suppuration and necrosis and the ultimate distribution of the septic material throughout the system. The process occurs in about the same location as does acute endocarditis, save that the aortic valve is more commonly involved than the mitral. The process leads to embolism, septicemia and local destruction of tissue.

CHRONIC ENDOCARDITIS.—**Synonym.**—Chronic valvulitis. This process is identical with atheroma of the aorta—either the result of acute endocarditis, which is the more common, or it may have been a chronic condition from the beginning. It usually affects the mitral and aortic valves and the endocardium of the left side.

It seems to be caused by syphilis, gout, or by such mechanical strains as lead to endarteritis.

Macroscopical.—There is an alteration and thickening in the valves, caused by the proliferation and organization of cells; there is also a fibrous, contracted and atheromatous condition of the valves and leaflets leading to the formation of calcified plates; consequently the blood flows continuously, causing a constant irritation of the ulcerations, which heal very slowly.

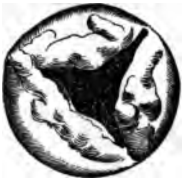
FIG. 40.—Insufficiency and stenosis of aortic orifice. Thickening and shortening of valvular flaps. Natural size.

The progressive stages of the condition are as follows: (1.) Thickening; (2.) Stiffening and contraction; (3.) Fusion and adhesion of valves; (4.) Chronic valvular aneurism or calcification. Thickening differs from that of acute endocarditis in being firm and not breaking up.

Fusion in chronic endocarditis causes insufficiency and stenosis, while in the acute endocarditis the blood is not restrained by the valve and flows in either direction, giving rise to insufficiency.

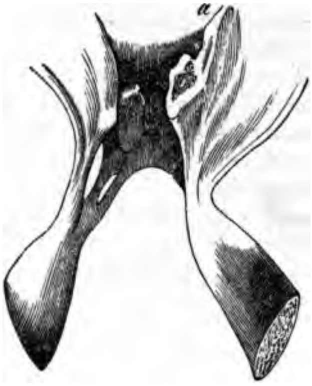

FIG. 41.—Insufficiency and stenosis of the mitral valve. The valve has been converted into a rigid funnel, cut open at *a*, the papillary muscle separated from the walls of the heart At the section *a*, and in the background, we see the thickening of the valvular flaps. At *a* also a calcified granule. The thickened chordæ tendineæ fused into a few strands, also the apices of the papillary muscle tendinously indurated.

CHRONIC VALVULAR ENDOCARDITIS.—**Synonym.**—Endocarditis of the cavities. This is an inflammatory condition affecting most frequently the left ventricle near the apex, or it may involve the septum.

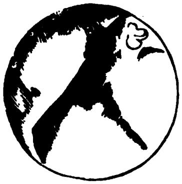

FIG. 42.—Fusion of the right and posterior valvular flaps of the aortic valve, at *a*, the line of fusion. Sufficient valve of two flaps.

We find about the same phenomena attendant here as in the other varieties of endocarditis—*i. e.*, ulceration, thickening, connective tissue patch, etc.

Later, we may have a cardiac aneurism formed where the fibrous patch occurred, with oftentimes the formation of heart polyp.

As a result of this condition, there may be stenosis and insufficiency.

TUMORS.—The heart muscle may be the seat of syphilitic gumma, secondary cancer and sarcoma. Primary growths are fibroma, myoma, lipoma. Tubercle occurs in the pericardium.

ALIMENTARY CANAL.

HISTOLOGY.—In the upper part of the pharynx the epithelium is columnar and ciliated and extends down into the mucosa, while the epithelium in the lower part of the pharynx and of the esophagus is of the pavement form, resembling cutaneous epithelium, save that it is more delicate and is not horny. The mucosa consists of fibrous tissue, from which the papillæ arise, and on which the deep epithelial cells rest. The mucosa is supplied with a dense network of lymphatic vessels, and is, except in the esophagus, continued into the sub-mucosa, which is composed of a loose and more laminated connective tissue, containing many fat-cells, the large vessels, nerves, glands, etc.

The sub-mucosa contains the large mucous glands, which are large and numerous in the mouth and diminished in number in the esophagus.

MALFORMATIONS.—Malformations of the lips, cheeks, etc., are usually associated with defective bony formation of the mouth, and usually belong to the cleft-palate class.

HYPERTROPHY.—The lips and cheeks may be hypertrophied, as in elephantiasis, in which there may be an increase in the anatomical elements or an excess of and dilatation in the lymphatic vessels, giving an edematous enlargement.

THE MOUTH.

CATARRHAL STOMATITIS.—Is usually found in children, and may result from a variety of local or constitutional causes.

There is congestion, swelling and increased formation of mucus, which flows from the mouth; or the formation may be supplanted by an excessive dryness of the surface.

There is degeneration of the epithelial cells, and the formation of pus and infiltration of the stroma.

CROUPOUS STOMATITIS is the result of an extension of a croupous process from the pharynx, and is also associated with fevers and diphtheria. The membranes are swollen, congested and covered with a false membrane consisting of a thickened layer of epithelium undergoing coagulation necrosis. There is naturally fibrin and pus present.

FOLLICULAR STOMATITIS.—This process involves the mucous glands, which become filled with infected material.

Primarily, there are small, hard and red elevated points, which often become soft and burst, emptying themselves and leaving small, round, follicular abscesses, which are very red, painful, and heal slowly.

APHTHOUS STOMATITIS.—*Aphtha* may be *discrete* when the patches remain *single*, or *confluent* when they coalesce. It is a local inflammatory condition, having a tendency to form ulcers.

Macroscopical.—The patches vary in size and are of a yellowish color, while the surrounding mucous membranes are injected, red and swollen.

Microscopical.—There is swelling of the epithelial cells, with an exudation of fibrinous lymph and leucocytes. There are small vesicles formed, which undergo coagulation necrosis, fatty degeneration and ulceration.

ULCERATIVE STOMATITIS.—This condition, which is of a more serious nature than the previously-described conditions, usually begins about the gums, especially those of the lower jaw, at the root of the incisors.

The gums are swollen and coated with a soft, grayish material, composed of bacteria and decomposed matter.

The gums may be destroyed, the teeth may fall out and the process may be extended even to necrosis of the alveolar cavities, while there is naturally involvement of the cheeks, lips and tongue.

Cause.—Mercury or other poisons.

MYCOTIC or PARASYTIC STOMATITIS (Thrush).—Here we find red patches, having a whitish apex, and coalescing in large numbers. They are of a soft consistency, resembling curdled milk, and easily removed. The condition is caused by the *Oidium Albicans*, a fungus of a transitional form, between the yeasts and moulds, and resembling to a certain extent that form which gives rise to barber's itch.

Its development is facilitated by uncleanliness and weak systems.

The process usually begins at the corners of the mouth or on the cheeks or gums, and spreads rapidly backward, even as far as the stomach. It has sometimes caused obstruction in the esophagus.

GANGRENOUS STOMATITIS—CANCRUM ORIS, NOMA.—This is a rare but serious condition, involving primarily the inner side of the cheek, which becomes hard, swollen and edematous, while the skin is shiny and red. Later, as the process advances, the centre of the sore loses its redness and finally becomes black, when the gangrenous process becomes general. The inflammatory point becomes a slough, the "core" of which may drop out, leaving a deep ulcer, or it may become so general as to cause the teeth to drop out and even produce death.

MERCURIAL STOMATITIS.—This condition is the result of the excessive use of mercury or some of its salts. The gums, which become red, are very sore and bleed easily.

Saliva is increased, and gray ulcers and sloughs may form, or the process may be so severe as to cause the teeth to drop out.

SYPHILIS.—*Mucous patches.* These patches occur about the tongue, lips, cheeks, as small, flattened and white spots, having a peculiar moist surface. They may be indurated and thickened and lead to ulceration.

Microscopical.—There is an exudation of fibrin. The polygonal cells are much swollen, while the rete malpighi is either swollen or broken down.

The vessels are much distended, about which there is a great accumulation of small round cells. The connective tissue around the vessels is much swollen, and in the lymphatic tissue there is an accumulation of fibrinous lymph.

TUBERCULOSIS is rarely seen as tubercle or ulcer in this location, but may occur.

TUMORS.—Sarcoma occurs in the mucous membranes or about the bones. (Epulis.)

Carcinoma epithelioma occur frequently upon the lower lips, said to be produced by irritants, as holding pipe in mouth, and begins as a papula, later ulcerating and leading to metastatic conditions.

THE TONGUE.

MALFORMATIONS.—There may be partial or entire absence of the tongue, or it may be attached to the floor, roof or sides of the oral cavity, or the frenum may extend to the tip of the tongue, or it may be abnormally short.

HYPERTROPHY.—This frequently occurs in cretans, and is usually a congenital condition.

There may be dilatation of the lips and lymphatic vessels.

Inflammatory conditions of the tongue are usually associated with similar conditions of the mouth.

SUPERFICIAL GLOSSITIS.—This condition may be *acute* or *chronic*, and is a simple inflammation involving the mucous membranes, presenting the usual phenomena of inflammation. The chronic form may cause hypertrophy of the papillae and an increased production of epithelium. Mild cases are frequently caused by stomach disorders, while more severe forms may arise from local or constitutional causes, as poisons or syphilis.

PARENCHYMATOUS GLOSSITIS may be caused by poisons or syphilis. The muscular and connective tissues are infiltrated with serum and pus and may lead to the formation of abscess.

The whole organ is congested and enlarged.

SYPHILITIC GLOSSITIS.—There are mucous patches or gummata upon the surface or in the structure of the tongue, leading to ulceration of the stroma.

TUBERCULAR GLOSSITIS.—Tubercle granule and granulation tissue are often found, causing small tumors beneath the epithelial layer of the connective tissue of the tongue, in tuberculous cases.

TUMORS.—Cysts, which are formed by dilatations of the ducts of the salivary glands, are found in the connective tissue under the tongue or in its substance.

Carcinoma may occur in the tongue, or may be an extension from a similar growth in a neighboring structure.

Lipoma, fibroma, angioma and sarcoma are comparatively rare.

PHARYNX.

INFLAMMATORY CONDITIONS.—These may be caused by irritants or by such systematic conditions as colds.

CATARRHAL PHARYNGITIS.—This condition may be acute or chronic and resembling simple inflammations of the mouth, with which the process is usually associated.

Pharyngitis is usually associated with inflammatory conditions of the tonsils and uvula, at which latter point the hyperemia and swelling is conspicuous, due to the relaxed condition of the tissues at this point.

In severe cases there may be follicular inflammation or coagulation necrosis, which leads to the formation of vesicles, and these in turn *rupture*, leading to herpes.

TONSILLITIS.—This may be a general catarrhal inflammation associated with similar conditions in neighboring parts, or there may be *lacunal tonsillitis*, a process confined to the lacunae, which are small follicles of the tonsil lined with epithelium. In sub-acute cases the products of the process are accumulated in the follicle, which become fatty, degenerated and decomposed, and either discharged as small fibroid plugs or become calcified in the follicle.

In the acute form the contents are discharged upon the surface resembling the diphtheritic membrane, but is softer and easier to remove than the latter.

When the contents are retained, suppuration results, which may lead to an extensive abscess of the tonsil, which usually ruptures into the throat and granulation occurs. On the other hand the abscess may cause rupture of a blood-vessel and consequent hemorrhage, or it may kill by suffocation.

DIPHTHERIA OF PHARYNX.—There is a formation through exudation, of a false membrane, on the mucous membranes of the upper part of the pharynx and palate. The connective tissue is infiltrated with fibrin and leucocytes, accumulated about the distended blood-vessels, in the areas of which hemorrhages are frequently seen.

The epithelium forms a network in which are seen great quantities of micrococci.

There is, associated with the symptoms of inflammation, a fibrous exudate infiltrating the mucous membranes, and uniting with the pus, bacteria, epithelial cells and granular matter, forming a pedicle upon the surface, which may undergo coagulation necrosis, extending into the mucous membranes. The false membrane may exfoliate without any apparent loss of tissue, or there may be many complications as abscess, edema, or metastasis to the lungs, liver, kidney, lymphatic system. etc.

SYPHILIS AND TUBERCULOSIS.—There may be evidence of these conditions in the pharynx, as in the mouth or tongue.

ESOPHAGUS.

Pouches or diverticula are formed in the esophagus as a result of various causes. In the upper portion of the tract they occur upon the posterior wall, while those occurring upon the side walls are usually congenital. Occurring in the anterior wall they are usually the result of diseased conditions of the lymphatic glands, in front of the esophagus.

Not infrequently materials collect in these pouches, causing decomposition and abscess. This and chronic inflammation leads to the formation of connective bands between the deceased gland and the wall of the esophagus, giving rise to a funnel-shaped diverticula.

Inflammatory conditions are usually due to irritants, poisons, etc.

CATARRHAL ESOPHAGITIS.—This may be acute or chronic, the latter leading to relaxation, dilatation, and ulceration of the walls, or hypertrophy of the muscular coats.

CROUPOUS ESOPHAGITIS.—Occurs as the result of a croupous process in the pharynx, exanthemata, or other irritating conditions or poisons—as acids, which destroy portions of the mucous membrane leading to necrosis; which, in case of recovery, slough off, leaving a granulating surface, which often leads to stricture of the esophagus.

STRICTURE.—Usually occurs opposite the cricoid cartilage or the tracheal bifurcation, because of their exposure to the action of irritants. As before stated, stricture may be caused by external pressure; contraction, the result of irritation, or of connective tissue contraction resulting from abscess or ulceration.

HEMORRHAGE in the esophagus may be caused by the rupture of veins which may have become much dilated, as a result of any of the above conditions.

TUMORS.—Cancer may be found at the cricoid, or at the tracheal bifurcation, being the point most exposed. Papilloma occur throughout the entire length of the esophagus.

Fibroma, lipoma, myoma, carcinoma, and adenoma are found throughout the pharynx and esophagus.

THE STOMACH.

HISTOLOGY.—The stomach is a movable organ, lying principally in the left hypochondriac region. The esophageal or cardiac portion is the more stationary part, and lies to the left of the twelfth dorsal vertebra; from this point it extends to the left and terminates in the duodenum. We find an arrangement of the layers of the mucous membranes similar to that of the esophagus. In the mucosa we find imbedded numerous glands, which at the pylorus are called pyloric *glands, while in the* remaining portion of the stomach they are known as peptic glands. The cardiac glands have a short neck, which divides into several tubes below, while the pyloric glands have longer necks, and divide into several pouches.

The function of the stomach is to convert albumen into peptone, the action of which is governed by a system of nerves whose ganglia are located in the walls of the organ, while the process itself is accomplished by a pepsin, favored by the presence of hydrochloric acid, which latter is produced by the cardiac glands. The pepsin originates in the main cells throughout the stomach.

Outside the mucosa we find the sub mucosa. Both of these layers are non-elastic, hence contraction in the tissue leads to the formation of ridges, occurring more frequently in a longitudinal direction.

The mucosa muscularis is a portion of the mucosa lying between the latter tissue and the sub-mucosa. It is composed of non-striated muscular tissue, having a circular arrangement on the inside, but externally it is longitudinal. The mucosa is quite a dense tissue, due to the compact arrangement of the glands which it contains, and between which we find a delicate connective tissue in which are the capillaries supplying the glands, and arranged vertically to the surface.

The whole mucous membrane is covered with columnar epithelium —secreting mucus.

We also find numerous small ducts which lead from the glands.

From the above one will readily see that the stomach is exceedingly prone to inflammatory conditions. The blood-vessels play the part of a lung. The arteries encircle the base of the glands, while the veins girdle the orifices, the latter absorbing the nutritive material, while the arteries furnish the gastric juice.

There is always a hyperemic condition present during digestion, consequently the necessity of rest to an irritable stomach is evident. The whole stomach is enveloped in a layer of peritoneum, and it is through this surface that the arteries enter and ramify in the different layers of the stomach. The point of distribution forming a cone, the apex of which reaches into the sub-mucosa, while the base rests upon the mucous membrane.

MALFORMATIONS.—The stomach may be entirely absent, very small, or the cavity may be divided into two parts by a constriction through the middle. The pyloric orifice may be entirely closed or stenosed.

CONGESTION.—It may be the result of most any irritation, and when continued leads to chronic inflammation. Active congestion gives a bright red color, while passive congestion, which is liable to become chronic, resulting from an obstruction of the heart or liver circulation, gives rise to pigmentation.

HEMORRHAGE. — **Hematemesis.** Hemorrhage in the walls of the stomach is often caused by infectious diseases.

HEMATEMESIS.—May arise from (1.) rupture of the blood vessel wall, as from cancer or ulcer; although there may be bleeding from a cancerous mass without direct rupture of a vessel. (2.) Acute infections, or other febrile conditions. (3.) Chronic gastritis and cirrhosis of the liver. (4.) Rupture of an aneurism.

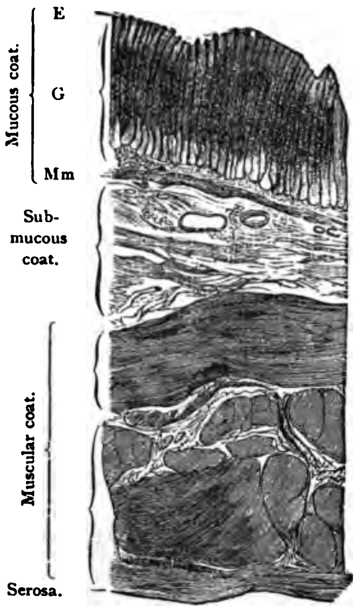

FIG. 43.—V S. Wall of Human Stomach. *E.* Epithelium; *G.* Glands; *Mm.* Muscularis mucosæ.

ACUTE CATARRHAL GASTRITIS.—A catarrhal process in which the mucous membrane is swollen, red, and covered with an increased amount of mucus, especially at the pyloric end, while the glands are dilated, the blood-vessels inflamed, and there is an infiltration of round cells between the tubules.

The condition is caused by irritants, or it may be a symptom of some acute infectious disease.

CHRONIC CATARRHAL GASTRITIS.—This is quite a common condition, occurring as a result of alcoholism or continued congestion or inflammation, and is often associated with diseases of the liver, heart or lungs.

The stomach varies in size. The inner surface is covered with a thick mass of tenacious mucus, especially at the pyloric end.

The mucous membrane is congested and of a variable thickness, *or it may* be formed into projections from the surface.

There may be cystic degeneration or atrophy of the gastric tubules; the cells of which become degenerated and broken down.

There is usually thickening of the tissues and pigmentation.

SUPPURATIVE or PHLEGMONOUS GASTRITIS.—A condition associated with which there may be the formation of abscesses in the sub-mucosa, as in other connective tissues, appearing as round elevated swellings, which may rupture and lead into the stomach by several openings, or may extend outward to the peritoneal covering. The idiopathic form is rarely seen, but several cases have been reported.

There may be one or two abscesses, or the process may be more general, involving the whole wall of the stomach.

CHRONIC or PERFORATING ULCER.—This ulcer, which is very common, usually occurs singly, frequently upon the posterior wall or in the lesser curvature.

Macroscopical.—The ulcer is of a round or oval shape, the edges of which are seldom injected or raised above the surface. In some instances only the mucous membranes are involved, while in other cases the whole wall may become involved, causing in many cases openings into the surrounding tissues, peritoneum, or blood vessels, which naturally results unfavorably; although healing may occur after perforation, leaving but an indistinct scar.

Gastric ulcer is a true ulcer, the result of thrombosis, and followed by hemorrhagic infarction, which, as previously explained, assumes a conical shape, due to the fact that in this condition the blood oozes in the area of the terminal blood-vessels; hence, the apex of the cone is away from the cavity of the stomach. The area of the hemorrhagic infarction is eaten out by the digestive action of the gastric juice, leaving the ulcer, which may involve one or all three of the membranes.

The ulcer is "crater-shaped," has sharply-defined edges, and affects usually the lesser curvature of the stomach, especially in young women, usually servant girls, who are subject to heavy lifting, irregularities in diet, etc. It is rarely formed on the anterior surface of the organ, or in the larger curvature, and is found less frequently in men.

Terminations.—The process may heal by cicatrization, or it may terminate in fatal hemorrhage or perforation, and subsequent death from peritonitis, etc. Again, adhesions may form to neighboring organs, giving rise to subsequent perforation, and formation of abscesses in these organs.

Cicatrization occurs when the ulcer is small and the surrounding conditions are favorable.

There may be perforation of blood-vessels usually involving the splenic artery, which usually results in death. Anterior perforation is rare.

DIPHTHERETIC GASTRITIS.—This condition, as the name indicates, may be of a croupous or diphtheretic nature, or there may be a coagulation necrosis due to infectious diseases, poisons, etc. The necrosed area, as in other localities, ulcerates, granulates and the tissue recovers its normal functions.

DILATATIONS of the stomach frequently occur as a result of pyloric stenosis, obstruction in the intestines, etc.

TUMORS.—The cancer occurring at the pylorus is found more frequently than any other tumor. Papilloma, lipoma, fibroma and myoma are occasionally seen.

SMALL INTESTINES.

HISTOLOGY.—As in the stomach we find the muscularis mucosa connecting the sub-mucosa with the mucosa; the latter resembling adenoid tissue, is composed of a reticular matrix, in which are arranged the large nucleated endothelial cells and lymph corpuscles.

This mucosa contains the follicles of Lieberkühn, which are arranged vertically, closely compacted, and extend from the free surfaces of the mucous membranes, where they open, to the muscularis mucosa.

These glands are lined with "goblet" columnar epithelium, as is the free surface of the mucous membranes. The mucous membranes lining the small intestines are thrown up into numerous villi, which is covered, under the epithelium, by a network of capillaries, among which we see ramifying one or two chyle vessels. The capillaries derive their blood supply from an artery running in about the middle of the villi, while the blood is carried off by two veins.

The follicles of Lieberkühn open between the villi, after ramifying among the capillaries.

The "solitary lymph follicles" exist in the sub-mucosa, but extend into the mucosa.

Peyer's glands are also located in the sub-mucosa, and consist of groups of lymph follicles and extend, as do the solitary glands, to the *free surface of the* mucosa.

CATARRHAL ENTERITIS.—This condition is usually caused by irritation, as in the stomach, or it may be caused by bacteria present in some infectious or specific form, or the process may be caused by tainted food, as cheese or milk. There are present the usual inflammatory symptoms, with an excessive formation of mucus. The terminations are in resolution or the process may lead to—

FOLLICULAR ENTERITIS.—A condition in which the solitary follicles become very much enlarged, of a pearly gray color and surrounded at the base by a hyperemic zone.

This process continues, when too severe to terminate favorably in the subsidence of the inflammatory condition, until we have the formation of small and deep abscesses, which are about the size of a pea. The Peyer's glands become involved, leading to the formation of large abscesses, and finally, on rupturing, the umbilical ulcers are formed, which, however, heal quickly. In follicular enteritis the Peyer's patches are swollen, and the surface is smooth and inflamed, while in the patches of typhoid, which are irregular and pale, there may be ulceration.

Follicular enteritis is usually due to some infectious condition, as scarlet fever and diphtheria, in which the lymphoid elements of the intestine are involved, as they are in other locations in these conditions.

CHRONIC ENTERITIS is a condition seldom seen. Theoretically the process is hardly plausible, on account of the arrangement of the blood-vessel.

TYPHOID ENTERITIS.—A specific inflammation, having, besides the phenomena of ordinary inflammation, that of medullary infiltration superadded. The process affects the solitary and Peyer's glands throughout the large and small intestines, but those near the ileo-cecal valve are the more seriously involved.

There are four stages in the process:

(1) Hyperemia and enlargement of the follicles, due to infiltration of the cells into the Peyer's patches and solitary patches, which consequently become enlarged and prominent. The cellular infiltration may extend to the surrounding tissue, which is in a hyperemic condition, while the glands are grayish in color, resembling convoluted brain substance.

(2) Next there is medullary infiltration, which is a process found in those cases of inflammation which do not terminate with follicular

enlargement, in resolution, but go on to more serious complications. We find the processes extending in the connective tissue, as well as in the glands, until ultimately the follicles rupture, their contents become discharged, and the glands become reticulated.

(3) Softening or coagulation necrosis comes next; when the new tissues which have died have become disintegrated, and are absorbed by the blood-vessels, the gland returns to its normal condition.

The most characteristic termination, however, is in the formation of the "typhoid ulcer," the result of the sloughing off of the dead tissue formed by the preceding process.

Although this sloughing process may attack the gland uniformly, it usually begins at different points, eating away small portions until eventually the whole patch is involved. The ulcer has fairly well-defined edges, which are thin and fringed, and have a smooth base resting on the submucous or muscular layer of the gut. The length of the ulcer is in the longitudinal direction of the gut.

When perforation exists the contents of the intestines are discharged into the peritoneum, which usually results fatally.

When this is not present, cicatrization occurs, which results in the adhesion of the undermined edges with the floor of the ulcer, resolution of the infiltrate and the formation of an epithelial covering over the surface of the sore. While this process does not restore the glandular structure, nor the high degree of vascularity which previously existed, it is to be preferred to a secondary ulceration which results in perforation, peritonitis and profuse hemorrhage.

The process may even extend to the liver, spleen or mesenteric glands, which later pursue nearly the same course, except that we often find calcification resulting.

The mesenteric glands are involved in a manner similar to that seen in the Peyer's patches or solitary glands, but not so extensive.

In nearly every case of typhoid fever the spleen is enlarged, due to congestion and increase of its normal elements. It begins to increase in size with the commencement of the disease and does not subside until after the third week. The follicles of the base of the tongue and of the tonsils are enlarged.

The floor and sides of the mouth and pharynx may be ulcerated and gangrenous, while the muscles of the tongue may become degenerated.

***TUBERCULOUS* ENTERITIS.**—This is also a specific inflammatory condition and resembles the typhoid form, save that the ulcer, instead of having a defined and fringed undermined edge, has a thickened and indured base and edges; but above all, it usually assumes a transverse direction to the gut, from the fact that the tuberculous material is deposited around the blood-vessels which, having a circular arrangement, gives an ulcer in the same direction. It affects the same glands as does the typhoid process and pursues nearly the same course, save that although the ulcers rarely heal, there is seldom perforation.

The nodules are formed, become elevated, soften, caseate and finally, through gradual extension, the entire gut is destroyed.

TUMORS.—**Polyp or adenoma** exists. Composed of distended mucous follicles, the interior of which is divided by connective tissue, which is supplied with blood by an artery and vein flowing through the pedicle.

LARGE INTESTINE.

HISTOLOGY.—It resembles the small intestines, save that we have only the longitudinal layer of the ligamenta (which is thickened) present.

The muscular layer is arranged in strips of such meagre proportions that sacculation is caused, giving rise to serious inflammation.

There are no villi nor Peyer's glands, while the solitary glands are larger than in the small intestines.

ACUTE CATARRHAL COLITIS.—An inflammatory process occurring in the large intestine as a result of fetal impaction or irritating foods.

The solitary glands are enlarged and conspicuous. The mucous membrane is hyperemic, while the folds which have been formed seem to be the favorite seat of this destructive process. We find the crests of the folds have been eaten away and are covered with a fibrous material. As the process extends, the surrounding tissue becomes involved, and the fibrous material becomes more extensive, the glands slough and give us large, rapidly-spreading circular ulcers, while the serous and muscular coats become involved, and the fibrinous material forms adhesive bands, uniting the serous coat to neighboring parts.

The intestine, as a result of this inflammatory process, becomes enlarged, and when the fibrinous material is abundant we find diminution in the lumen. There may be hemorrhages and copious watery discharges. The catarrhal process is usually the first stage in all dysenteries.

CROUPOUS or DIPHTHERETIC COLITIS.—The process resembles the same form of inflammation occurring in the pharynx, save that coagulation necrosis is more severe in the intestine. Large portions of the mucous membranes become nasty, black sloughs, under which, in the submucous tissue, is serum and dark blood; later suppuration is established.

The membrane is thrown off, which, however, is rarely completely accomplished; usually there is a connective tissue formation left.

CHRONIC COLITIS.—Results from either the acute catarrhal or diphtheretic processes.

There is thickening of the mucous membranes and muscular coats, with contraction and narrowing of the lumen; occasionally abscesses and fistula are formed.

PSEUDO-POLYPOSIS occurring as a sequllæ of chronic dysentery; is characterized by false polyps, formed by the constriction of the mucous membranes, which in turn is caused by cicatrization occurring in the ulcers.

FOLLICULAR COLITIS.—A condition in which the lymphatic nodules of the colon become swollen, later softening and forming ulcers.

The process is usually associated with the catarrhal or croupous inflammation, although in "army" dysentery or that occurring in children, the condition seems to exist independently. The tissues are thickened and the ulcers have a tendency to become chronic.

CECUM.—Catarrhal inflammations having a chronic course, with acute exacerbations, occur quite frequently in the cecum, and are usually caused by continued constipation, dyspeptic or fermentative conditions, or impaction of feces. Following the ordinary changes of chronic catarrhal inflammation, there is a suppurative process which leads to ulceration and finally perforation, which may be partially closed by adhesions or abscesses, or sinuses may be formed.

The feces may pass through the perforations into the peritoneal cavity.

TYPHLITIS.—An inflammatory process about the cecum, caused by irritative conditions occurring in the cecum, as a result of fermentation, etc.

PERITYPHLITIS.—This condition is an intense and extensive form of typhlitis, leading to the formation of ulcerations and abscesses, or the process may terminate in resolution. The perityphlitic abscess may open into the peritoneal cavity, the intestine or externally.

Catarrhal processes about the cecum are commonly seen in post-mortems, as atrophic patches upon the mucous membrane.

VERMIFORM APPENDIX.—This pouch, which is frequently involved in a process of suppurative inflammation, is a small projection of tissue, rarely having a mesentery of its own, and consequently deriving its vascular supply from some portion of the cecum, consequently any pressure upon the latter interferes with the circulation in the appendix, which leads to inflammation, suppuration, gangrene and rupture.

RECTUM-PROCTITIS.—A suppurative inflammatory process involving the connective tissue about the rectum, which may lead to hypertrophy, polypoid excrescences and ulcerations.

These abscesses may rupture into the viscera or externally, which, when occurring near the anus, constitutes a condition known as *fistula in ano*.

TUMORS—Polyp, cylindrical or squamous epithelioma. The cylindrical, giving rise to cauliflower growths, while the squamous grows just inside of the anus; of a fungoid character and may be specific.

Glandular cancer is the more common tumor, and may be hard, soft or colloid. They may encircle the rectum, ulcerate and cause constriction.

RESPIRATORY SYSTEM.

HISTOLOGY.—We find that the membranes lining the air passages differ from all other mucous membranes in containing a large amount of yellow elastic tissue, which is found principally in the submucous tissue. Again this latter tissue is separated from the mucous tissue by a layer of basement membrane; we also find that the blood-vessels, which have unusually strong muscular walls, are widely distributed throughout the tissue, consequently inflammations and infiltrations occur more rarely in this location than in other mucous membranes, and when a process is established, it usually disappears rapidly. We seldom find edema in a post-mortem on account of this elastic tissue.

In the upper part of the larynx and cords, we find striated squamous epithelium. While throughout the remainder of the respiratory tract we find the epithelium single, columnar and ciliated, with the exception that in the small bronchioles and air vesicles, the epithelium is single and squamous.

The unit of lung structure is the acinus, varying in size from that of a pinhead to a pea, and composed of the following:

The infundibulum is a dilatation of the bronchiole into which terminate the aveolar passages, each of which contains a number of air vesicles, and of course a number of united alveolar passages form the acinus, while a number of acini (15-20) form the lung lobule, which is about one-half inch square. Again a number of lobules form the lobes, of which we have three on the right side and two on the left side.

NOSE.

ACUTE RHINITIS.—An acute catarrhal inflammation of the pituitary or schneiderian membrane lining the nose and adjacent cavities, resulting from a sudden atmospheric change, exposure to cold, the inhalation of irritating gases or dusts, or in some cases may be epidemic.

The condition is characterized by feverishness, hyperemia. redness, swelling of the mucous membranes and a copious secretion of mucus.

At first this secretion is thin and watery and of a salty taste; but later, when the desquamation of ciliated epithelium becomes general, the discharge is thick and opaque, until pure pus is exuded.

The inflammatory process may extend to surrounding structures or to the ear, and produce serious complications. While changes in temperature are credited with being the cause of the condition, it is probable that such are merely incidental, although the membranes being highly sensitive, a change in temperature or inhaling irritating dusts causes considerable annoyance.

CHRONIC RHINITIS.—(Ozena, Rhinitis Hypertropica).—A chronic inflammation of the membranes lining the nasal cavities, having a tendency to produce connective tissue, which often becomes atrophied. The condition is caused by repeated attacks of inflammation or the continued inhalation of irritating dusts or vapors, or some constitutional disease. With this process there is impairment of the senses of smell, taste and hearing.

The mucous membranes are dark and congested, sometimes ulcerated, while the discharge is thick, greenish and of a very disagreeable odor.

CIRCULATORY DISTURBANCES.—These are frequently seen owing to the erectile nature of the sub-mucosa. Congestions are frequently found and often associated with—

NERVOUS DISTURBANCES.—Under which heading are placed such reflex conditions as asthma, or persistent cough.

EPISTAXIS is probably due to some heart complication or nervous conditions in which excitability results, or it may be due to blood diseases, as anemia, hemophilia, scurvy, etc.

INFECTIOUS CONDITIONS.—Prominent under this heading we find influenza, an intense process caused by micro-organisms, leading to marked involvement of the mucous membranes and oftentimes to dangerous sequelæ. Glanders, farcy, and similar infectious conditions are seen involving the mucous membranes of the nasal passages.

CHONDOLOMATA and GUMMATA of SYPHILIS invade the structures, causing degenerations and leading to chronic rhinitis and atrophy.

MILIARY TUBERCLE and ULCERS are frequently found, especially in so-called rachitic or scrofulous children.

LARYNX.

ACUTE CATARRHAL LARYNGITIS.—This is simply a mild catarrhal inflammation of the mucous membranes of the larynx, accompanied by hyperemia and febrile symptoms.

The patches of membrane are wholly superficial. The underlying tissue is found to be unaffected, upon detachment of the particle.

The inflammatory process may be confined to the follicles, especially those about the epiglottis, which become swollen and have a tendency to break down, forming ulcers.

EDEMATOUS LARYNGITIS (Edema of the Glottis and Larynx.)—This is not a true edema but an inflammatory process of the submucous tissues, especially about the glottis, characterized by a serous effusion into the submucous layers of the connective tissue. As has been stated before, this serous infiltration disappears very rapidly in case of death and leaves few traces of its fatal character.

LARYNGISMUS STRIDULUS (Spasm of the Glottis) occurs in children in cases of dentition, etc., in which there is a temporary spasm in the muscles of the larynx. This condition is often mistaken for true croup.

CROUPOUS LARYNGITIS (Croup).—An acute inflammation of the larynx and trachea, with the deposition of an albuminous or fibrinous false membrane. In the meshes of this fibrinous deposit are found the leucocytes.

This condition may occur as an extension from the pharynx or trachea.

The membrane, which is of a brownish color, is easily removed save when invading surfaces covered with squamous epithelium.

DIPHTHERIA.—A specific inflammatory process due to the action of the Krebs and Loffler bacillus, producing albuminous poisons which enter the circulation, causing general disturbances and often leading to a multiple neuritis, which causes paralysis.

BRONCHIAL TUBES.

ACUTE BRONCHITIS.—An acute catarrhal inflammation affecting the mucous membrane of the medium-sized bronchial tubes.

The mucous membrane is highly congested, thickened and covered with a tough whitish secretion, poor in cells. Capillaries of the mucous membranes may rupture, giving rise to blood-streaked expectoration. The submucous tissue is hyperemic. The process affects the young and old, and is caused by climatic changes, etc.

The process is characterized by dyspnœa, the expectoration of fibrous masses, often casts of the bronchi. The process resembles asthma closely ; in fact it is probable that many cases called asthma are nothing more than bronchitis involving the terminal bronchioles. Further, the characteristic crystals (Charcot-Leyden) of asthma may be occasionally found in the sputa of this terminal form of bronchitis.

The process may arise from the extension of an inflammatory process from the larynx. In children the capillary bronchi are involved, often extending to the air vesicles and leading to catarrhal or lobular pneumonia, which often occurs as a sequelæ to measles, whooping cough, scarlatina, etc.

CHRONIC BRONCHITIS.—This process resembles a chronic inflammation of any mucous membrane except that the mucous follicles in this condition secrete actively.

Primary chronic bronchitis is caused by exposure to damp weather, irritating vapors, dust, etc.

Secondary chronic bronchitis is caused by constitutional diseases, or *it may be the result of* engorgement or tuberculosis of the lung, repeated attacks of acute bronchitis, or disturbances of the circulation. There are four classes. (1.) Those cases in which there is a thickening of the mucous membranes, leading to stenosis, dyspnœa, etc. (2.) Ulcerations, similar to those of laryngitis. (3.) Bronchiectasis, in which case the dilatation is caused by the mucous and catarrhal exudate stopping up the bronchioles. (4.) Tuberculosis, in which there are ulcers and nodes, or there may be simply a desquamation of epithelial cells filling the tubes, while the mucous membranes become infiltrated with the proliferated cells, and as a result we have cheesy necrosis.

The walls of the tubes are thickened by the inflammatory process, and the tissues are swollen, due to the peri-bronchial infiltration.

As in all similar conditions we have coagulation necrosis and softening, leading to the formation of cavities, or there may be organization and a fibrous peri-bronchitis resulting.

There may be a suppurative form of peri-bronchitis, the result of involvement or extension of the purulent form along the lymphatic vessels about the bronchi.

The process often arises in the pleura as a result of pleurisy or empyema.

ATELECTASIS—The collapse of a wedge-shaped area of lung substance. There may be four stages, and it is due to clogging of the vesicles with the plugs of degenerated tissue. The mass is finally released, but it is still impossible for the air to enter the acini, and as a result, collapse occurs. Over these collapsed spots, there is an area of depression in the lungs.

Hyperemia is caused by the blood rushing into the collapsed area. The blood is unable to return and we have splenization, which is a mixture of hyperemia (venous congestion) and edema, but it is not particularly characteristic of the collapsed portion of lung.

As a result of this vascular engorgement the area becomes dark red in color; finally the depression disappears; the tightly-packed blood cannot circulate; an infiltration of serum occurs, replaces the blood and changes the color from a dark red to a whitish tint.

Thus the edema crowds out the hyperemia, and we have remaining a chronic edema as the third stage, resulting from the venous congestion and inflammation.

Later the connective tissue becomes developed and pressed together. The pigment from the blood infiltrates the tissue, giving us a fourth stage, slaty induration. The atelectatic area is conical in shape on account of the manner of radiation of the branch, the base of the area being joined to the periphery of the lung.

In atelectasis of a newly-born babe we do not find the hyperemia (disproportion of blood and lung tissue) which always exists in the adult.

BRONCHIECTASIS.—This condition is due to obstruction of the bronchi by the catarrhal exudate and leads to the cylindrical and saccular dilatation of the bronchi, with attenuation of the walls.

The outer and muscular connective tissue suffers first, leaving only the mucous coagulation.

This condition differs from bronchiectasis in trachleo-bronchitis in not leading to an offensive discharge and not having thickening of the walls.

The catarrhal exudate may calcify and form bronchial calculi, either in the bronchi or ultimate structures of the lung tissue.

The process may occur as a result of some forcible pressure or some condition which may have weakened the tubes.

Cylindrical dilatations result from uniform weakening, especially in the lower tubes.

Sacculated dilatations result from a localized weakening and usually involve the middle lobes.

Forces which may cause dilatation by pressure or distension are (1) forcible inspiration or (2) expiration, as in coughing.

As a result of bronchiectasis, we may have ulceration and gangrene, caused by the accumulated masses.

LUNGS

HYPEREMIA may be of several varieties, resulting from many conditions.

ACTIVE HYPEREMIA may be the result of lesions of the nervous system, leading to congestion of the lung. It may also be caused by excessive exercise, which causes engorgement, hemorrhage and occasionally death.

HYPOSTATIC CONGESTION results from disturbances of the pulmonary circulation, especially from complications of the right side of the heart, in which the vessels of the lungs are distended.

PASSIVE HYPEREMIA is usually the result of left-sided heart disease, in which cases the lung tissues become distended with blood, being unable to empty itself. There may be edema, being an infiltration of serum into the vesicles and interstitial tissues, or the process may be dry, that is, unassociated with edema, which is usually the result of cases occurring in the lung tissue which has retained its elasticity.

PASSIVE HYPEREMIA may lead to Brown Induration, being a hyperplasia of the connective tissue of the lungs and an exudation of a blood-streaked serum, resulting from diapedesis.

HEMORRHAGIC INFARCTION.—A circumscribed area of extravasated blood of a conical shape, due to obstruction of a small branch of the pulmonary artery or vein, causing red patches to appear upon the pleural surface of the lung, toward which is the base of the triangle; the apex being toward the base of the lung.

The infarct may be absorbed, leaving pigmentation, or it may become specific and lead to suppuration, forming a conical-shaped abscess, or in badly infected cases gangrene may result.

The process usually involves the basis of the lobe, while tuberculosis affects the apices.

Hemorrhages from the lungs may be caused by tuberculosis, aneurism, hyperemia, cerebral lesions, traumatism, or varicose conditions.

PNEUMONIA.—An inflammatory condition involving the lung structure and characterized by the presence in the air cells of the products of inflammation.

The causes of pneumonia may be various, but probably lobar pneumonia is due to the "pneumococcus," or "diplococcus" of Frankel, which is a bacillus of a lanceolate shape, occurring in pairs, or as chains; or streptococcus, where the shape may be spherical. When the organism is taken from the human body it is encapsulated.

The bacilli occur in the sputa, and in rare cases it is said to exist in the blood, and leads in severe cases to pyemia, endocarditis, pericarditis, otitis and meningitis.

ACUTE PNEUMONIA.—**Synonym.**—Common, fibrinous, croupous, or exudative pneumonia; pleuro-pneumonia, from the fact that the process is usually associated with pleurisy. Lobar, because usually the lobes are involved (over fifty per cent. of the cases involve the right lower lobe).

The process is an acute inflammatory condition of the lung, involving the vesicular structure, in which the alveoli are rendered impervious to the air, and in which there is an exudation of fibrin into the air vesicles.

The process may be divided into four stages:

(1) **Stage of Congestion or Engorgement**, with (*a*) hyperemia, (*b*) effusion. The vessels become congested and distended, and convolution follows, causing projection into the alveoli and consequent diminution of their lamina, causing edema. The air vesicles contain a viscid albuminous fluid which gives rise to the crepitant râle. The lung tissue loses its elasticity, becomes heavy, and naturally the resonance becomes impaired. The sections of the lung are still crepitant and float when placed in water.

(2) **Stage of Red Hepatization.**—So called by Lannec because of its marked resemblance to a section of liver. In this stage there is an exudation of a viscid and fibrinous fluid, containing fibrin together with the red and white blood corpuscles of the blood, into the alveoli; this rapidly coagulates, and thus the alveoli are completely filled, and cysts formed. The tissue becomes less elastic, more dense, as well as heavier, than in the first stage. The vesicular murmur and crepitant râles are absent. As a consequence of this filling and loss of elasticity, it is impossible for the lungs to inflate; thus we have a bronchial breathing. The tissue has become so heavy that when placed in water it immediately sinks. The process of solidification begins, and is confined usually to the posterior portion of the lower lobe, from the fact that the effusion being fluid, gravitates to the most dependent parts.

There is usually considerable inflammation of the pleura about the affected area, which fact gives rise to the synonym pleuro-pneumonia. The extent of the pleural involvement may be so great as to conceal the pulmonary symptoms.

(3) **Gray or Yellow Hepatization.**—The only real difference between this stage and red hepatization is that the tissues are filled with pus, and is, as the name indicates, of a gray color, due to (1) the increase in the number of leucocytes. (2) The blood being pressed out of the tissue, causing anemia. (3) The catarrhal desquamation causing cell proliferation from the alveolar wall.

The lung tissue remains dense and inelastic. Fatty metamorphosis absorbs the greater part of the cellular elements, while the remainder is expectorated.

The process occurs at the same points as the red hepatization. The lung is hard, friable, heavy, breaks down easily upon pressure and *sinks in water.*

(4) **Resolution**, or purulent infiltration, may be considered the termination of the third stage. This stage is characterized by absorption and expectoration of the exudate from the air vesicles, in which process the alveolar walls are highly instrumental. Through degeneration the exudate becomes loosened from the walls of the alveoli, the fibrous materials undergo mucoid changes, while the corpuscular elements succumb to fatty metamorphosis, and the degenerated material is either absorbed or expectorated. The sputa contains not only cysts of the acini, but also blood, because after the disappearance of the matter, a reactive hyperemia, resulting from the relaxed condition of the blood-vessel walls is established, and this colors the sputa.

The crepitant râle may return when the air re-enters the alveoli, but all this ultimately disappears and usually terminates in recovery.

The name purulent is applied to this condition because of the infiltration of leucocytes into the connective tissue septa of the lungs. The tissues are soft and of a pale color.

The process may terminate in (1) *gangrene*, which may be caused by pressure upon the dilated bronchi, especially when full of fetid matter, or by excessive hemorrhagic infiltration during the second stage.

Gangrene sometimes appears in persons affected with pneumonia, complicated with chronic bronchiectasis. A part of the gangrenous matter may be expectorated.

(2) *Abscess* occurs during the fourth stage of pneumonia, at first being of a miliary nature.

The abscess is caused by intense inflammation and becomes a more active and virulent process than do cases which terminate in phthisis. The purulent infiltration peculiar to this stage is unusually intense, and there is a predomination of interstitial inflammation.

(3) *Phthisis* is not as frequent a termination of croupous pneumonia as it is of catarrhal pneumonia, and when it does occur there is a predominance of the catarrhal elements present.

CATARRHAL PNEUMONIA.—**Synonym.**—Broncho, lobular, tubular. This is an inflammatory process resembling lobar pneumonia, in that there is an exudation into the air vesicles of an albuminoid fluid containing red and white corpuscles and endothelial cells, but unlike it, in that there is very little fibrin formation and very little mucus, as in general catarrhal inflammations.

The condition is usually seen in children as a result of a capillary form of bronchitis arising from whooping cough, exanthemata, etc. The name lobular is not accurate, inasmuch as the process may be seen in hypostatic pneumonia, in which the contents of the alveoli are catarrhal. The lung is congested, and upon its surface are seen sunken purple patches of atelectasis.

There is marked engorgement of the blood-vessels, while the capillaries are tortuous and project into the air vesicles.

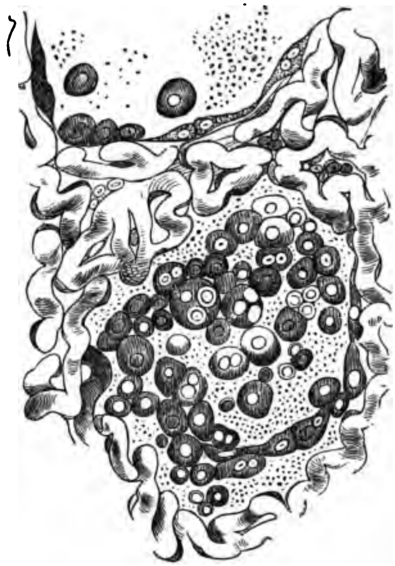

FIG. 44.—Catarrhal pneumonia. One and a half of an alveolus. The tortuous capillaries of the septa injected. Filling of the lamina with epithelial cells of the walls which multiply by division.

The lung tissue is usually more moist and smoother than in lobar, though small nodules ; the indurated lobules may be felt.

Aside from the atelectatic patches there may be seen the pneumonic patches, which resemble the former save that the surface is usually raised and about each of which the interlobular septa may be distinguished. The lobules may be distended with air, while in some cases *there is* emphysema. Later these purple patches become fused, in*volving a considerable* portion of the lung.

Upon microscopical examination we find the affected lobules to contain three zones.

In the centre is the small bronchus, having thickened and granular walls.

Around the bronchus, the air vesicles are filled with catarrhal cells and very little fibrin. In the outer zone there is capillary congestion. Catarrhal pneumonia is frequently associated with measles, whooping cough, tuberculosis, etc. It may prove fatal or terminate in resolution by means of fatty degeneration, and discharge of the exudate. In rare cases there may be suppuration or gangrene.

SUPPURATIVE OR PURULENT PNEUMONIA.—Suppurative processes may result from many conditions, as traumatism, aspiration of micro-organisms, etc.; chronic lung affections, as tuberculosis, or from neighboring points of suppuration, or abscess. It is usually caused by retained bronchial secretions. The infiltration with leucocytes becomes so rapid about the bronchus that an abscess is formed.

FIBROUS PNEUMONIA.—A condition resulting from cell proliferation and the formation of fibrous tissue. It may result from acute or catarrhal pneumonia or syphilis, in which there has been a proliferation of connective tissue cells and the formation of new blood vessels in the septa, which ramify in the meshes of fibrin, inside the vessels.

There is usually considerable pigmentation in fibrous pneumonia, which results from inhaling irritating material, though it may result from lobar pneumonia.

The lung is smaller than normal and firm, while the visceral pleura is greatly thickened and adherent to the costal layer. Passing from the deep layer of the pleura, are firm fibrous bands passing into the substance of the lung and joining the thickened walls of the bronchi and blood-vessels. The pleura is thickened and the connective tissue cells are seen along the lines of the lymphatics, through which the irritating particles travel.

Prominent among conditions which lead to fibrous pneumonia are such occupations as "coal mining" and "stone masonry." These conditions will serve as types for similar conditions occurring less frequently.

ANTHRACOSIS.—**Coal miners' phthisis.**—Occurs as a result of inhaling coal dust into the air passages and vesicles, from which point the particles work into the surrounding connective tissue, leading to catarrhal or interstitial changes. The lung tissue is much pigmented, swollen, heavy and solid. The pleural surface seems uniformly black; but upon close inspection it is seen that the pigment is collected in spots, while a radiating appearance corresponds to the arrangement of the lymphatics in the interlobular septa.

On section the lung tissue is solid, emphysematous to the touch and having small nodules scattered throughout the tissue.

The pigmentation is especially marked along the course of the lymphatics of the interlobular septa, while between the lobules the pigmentation is not so marked.

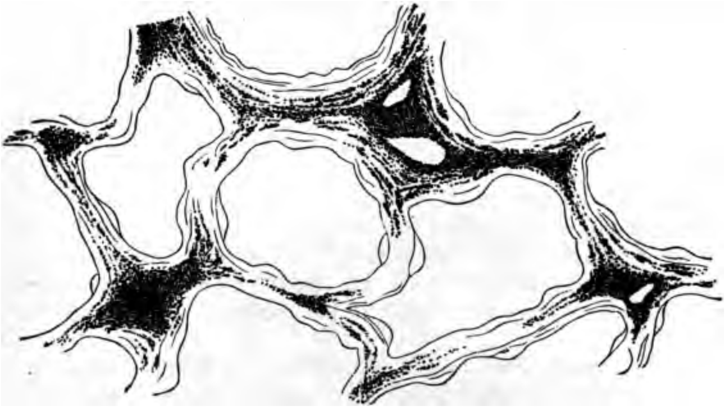

FIG. 45.—Anthracosis. Coal dust inhaled into the alveolar septa of the lung.

In the air vesicles the coal particles are seen in abundance.

SILICOSIS.—Stone-masons' phthisis.—A condition resembling anthracosis, save that the changes are more rapid and more marked because of the greater irritating power of the stone particle, which leads to a more rapid proliferation of the connective tissue and epithelial cells.

The fibroid and catarrhal changes occur more rapidly and lead to greater destruction.

Bronchiectatic cavities are found in this condition. The tissues are *firm,* while small hard nodules are scattered over the surface.

The centre of the lobule is yellow, surrounded by a bluish ring, outside of which is a pigmented zone. Between the nodules the interstitial tissue is greatly increased.

BROWN INDURATION OF LUNGS.—Synonym.—Chronic venous congestion. Brown edema. A hyperplasia of the connective tissue which is caused by a dilatation of the walls of the capillaries or by diseases of the valves of the heart, especially the mitral.

The orifices become closed, and finally the walls rupture and particles of blood become deposited in the connective tissue. Owing to the fact that there is an overgrowth in the unstriated muscular tissue in proportion to that of the connective tissue, the vesicles contract and expel the cheesy mass more readily than in kindred conditions; hence it is stated that "cases of heart disease seldom die of consumption."

The pleura has a peculiar brownish color, through which may be seen the deeply pigmented interlobular septa. The walls of the air vesicles are thickened and pigmented.

EMPHYSEMA.—By this term is meant a stretching and dilatation of the air vesicles.

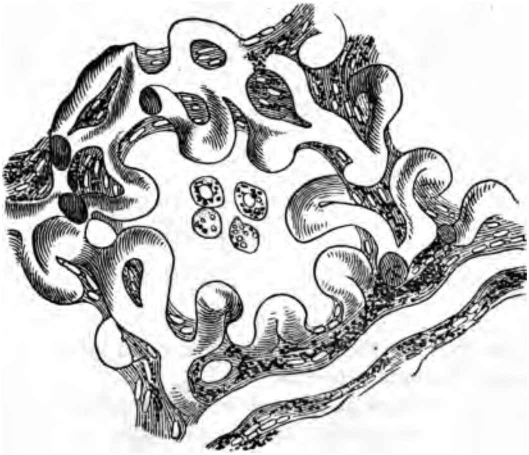

FIG. 46.—Brown induration. An alveolus of the lung with ectatic capillary vessels and deposition of pigment, partly in the connective tissue of the septa, partly in the catarrhal cells, which are in the lumen.

Emphysema may be (1) *vesicular*, a simple dilatation due to malnutrition of the lung tissue, or to some obstruction in the bronchial tubes allowing the air to enter the cavity, but furnishing no exit.

The tissue becomes weak and consequently the vesicles are easily dilated, especially near atelectatic areas. It also occurs associated with wasting conditions, or in old people, or may be brought about by coughing, etc.

Macroscopical.—The lungs are larger, but somewhat lighter than normal and of a reddish color, save near the apex. The air vesicles are distended and conspicuous. The condition is usually associated with bronchitis.

Microscopical.—The changes are most marked under the pleura, while the openings into the air vesicles are round instead of angular, and the capillaries form networks.

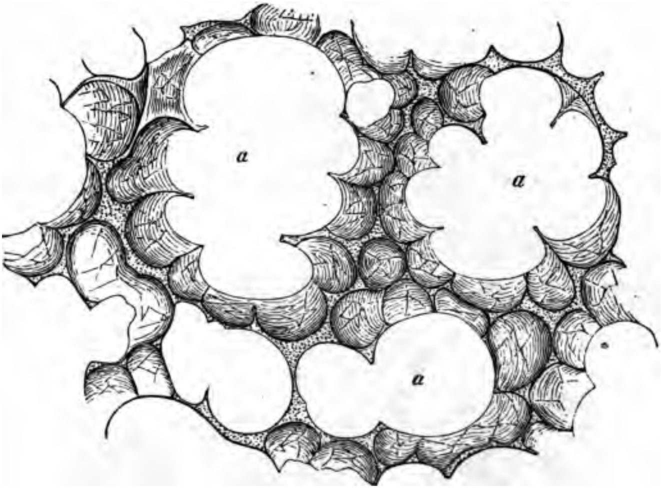

Fig. 47.—Pulmonary emphysema, first stage. Ectasy of the central cavity of the infundibula, *a, a. a.*

The epithelial linings of the vesicles are atrophied, granular and fatty degenerated, the former resulting from the obstruction to the circulation caused by constriction of the capillaries; further the degree of atrophy and fatty degeneration is governed by the amount of constriction. The walls are thickened, and there may even be atheroma *of the* branches of the pulmonary artery.

The obstruction causes dilatation of the right heart.

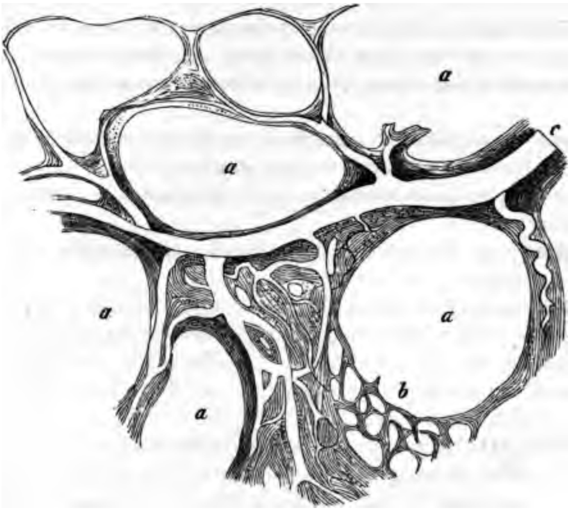

Fig. 48.—Pulmonary emphysema, later stage. The cavities *a a*, have been produced by the complete atrophy of the alveolar partitions, each of an infundibulum. partly also by the fusion of contiguous infundibula. (*b.*) Remains of septa which are characterized by their abounding in smooth muscular fibres. (Compare Fig. 49.) (*c.*) Branches of pulmonary artery.

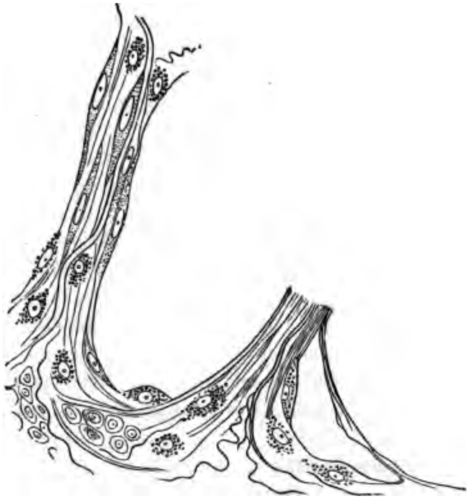

Fig. 49.—From the inner surface of a larger emphysema vesicle. Fatty remains of the *lung tissue, containing* elastic fibres, smooth muscular fibres, and covered with fatty degen*erated epithelia.* Compare 48, *b.*

(2) *Interstitial Emphysema.*—In this form the air is found in the interstitial connective tissue of the lung structure, usually resulting from rupture of the vesicle, caused by some extraordinary respiratory effort.

Cause.—Emphysema in general is caused by some distending force in tissues, having a tendency to degeneration.

These may be direct strains, or such conditions as asthma, bronchitis, etc.

In elderly people we find an atrophic emphysema, caused by atrophic changes of the septa.

In the expectoration of an emphysematous patient are seen gray specks, which upon being magnified are seen to be lobulated casts, produced by the dilated racemose glands. The distention of the veins causes a general venous stagnation, which may lead to congested kidney, nutmeg liver, etc.

TUBERCULOSIS.—An infective inflammatory process, the result of the bacillus, causing irritating and prolific changes in the endothelial or epithelial cellular tissues, followed by fibroid and caseous changes, both of which may be limited by the condition of the part and the activity and number of the bacilli.

The bacilli are rod-shaped, about as long as half the diameter of a blood corpuscle, slightly curved and containing spores. They usually lie near the epithelial or pus cells, though sometimes they are seen in the protoplasm, and are motionless.

The bacilli seem to affect surrounding tissues, even though they may not be present in these tissues.

The bacilli may enter the lung through inspiration, which is the more common manner of introduction, or it may possibly be carried through the vascular or lymphatic systems.

DISSEMINATED MILIARY TUBERCULOSIS.—The lung, which is deeply congested, has scattered over its surface many pale, gelatinous-looking and prominent nodules occurring over the lines of the interlobular septa. They are seen in the pleura, along the lines of the septa.

Microscopical.—Caseous masses are seen surrounded by reticular tissue, in the meshes of which are seen endothelial and a few small round cells.

Immediately surrounding the tuberculous nodule, the inter-alveolar septa are considerably thickened, and the epithelial changes are seen here. The caseation occurs in the centre of the nodule, resembling gumma.

The tubercular masses are purely extravascular, which is demonstrated by injecting a tuberculous lung; in which it is seen that as soon as new follicles are formed, the nutrition of the primary foci is cut off and caseous degeneration occurs.

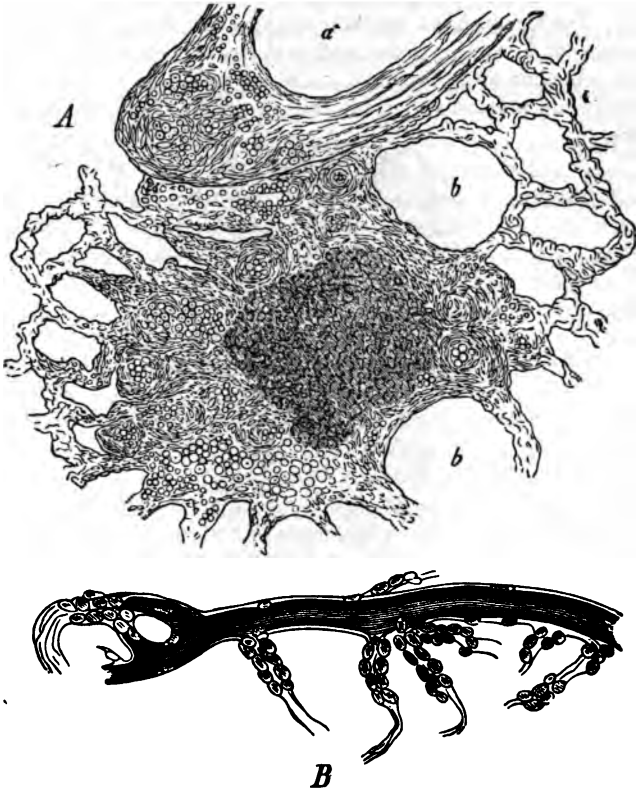

FIG. 50.—Miliary Tubercle of the Lung. *A*. Part of the cross-section of a small vessel in whose walls, as well as in the adjacent connective tissue, the cellular new formation has developed; which appears to the naked eye as white nodules. *A*, *b*. Infundibula. *B*. A transition vessel from the neighborhood, showing the increase of nuclei.—After Colberg.

Miliary tubercle do not all have the same structure; some resemble granulation tissue, while others are composed of tubercle tissue.

By tubercle tissue is meant an inflammatory product resembling granulation tissue; being composed of a basement material and some cells. The former has a reticular arrangement, is delicate and finely granular, and contains round and oval nuclei; while in the spaces of the reticulum are polyhedral, nucleated cells.

There are present also giant cells of various form, some being a part of the basement membrane, while others are distinct in the basement substance.

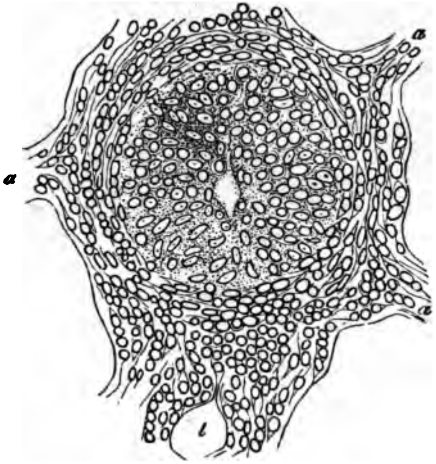

FIG. 51.—Cross-section of a lymph-vessel in tuberculous lymphangitis. (1.) Lumen of a vessel as yet but little degenerated. (a.) Alveolar septa, which proceed from the degenerated lobular septum.

Miliary tuberculosis is part of a general constitutional disease, resulting from infection and usually occurring in young people having a predisposition to the condition. As stated above, the miliary tubercles are uniformly distributed throughout the lungs, being deposited, either thickly or sparingly, according to the severity of the process. These, which are organized nodes, should not be mistaken for broncho-pneumonia foci. In the latter condition the acini of the lung are filled with loose catarrhal or tubercular exudate, which is *easily brushed* out, leaving a hole in the centre of the bronchus.

The lungs are crepitant throughout the process, and there are no cavities, and seldom any hepatization. Catarrhal pneumonia often complicates miliary tuberculosis in children. The tubercle exists in the wall, not in the cavity of the vesicle, and through irritation they cause an overgrowth of connective tissue; but should pneumonia complicate the condition, the vesicles become filled.

Calculi may form; those of phthisis are rough and may ulcerate into the bronchi, and become expectorated. Bronchial calculi are smooth.

CASEOUS BRONCHO-PNEUMONIC TUBERCLE.—A condition frequently found in children as a localized tuberculosis, being chiefly confined to the lung.

Macroscopical.—The lung tissue is congested, edematous, having occasional collapsed patches; while scattered over the surface are seen many nodules, which are especially prominent at the apices and roots of the lungs.

Upon pressure a muco-purulent material is pressed from the small bronchi.

Microscopical.—The small bronchi and alveoli are filled with cells resembling the catarrhal cells, among which are found the bacilli.

In the centre of the acini, at which point caseation is most advanced, is found considerable granular debris. The bacilli are found near the margins and near the inter-alveolar septa, and may be very numerous.

Giant-celled tubercles are comparatively rare, because caseation occurs so rapidly that it seems impossible for the follicle to reach such a stage of organization. These changes are conspicuous in the air cavities connected with the bronchioles; hence, upon vertical section the caseous masses are always near the bronchiole, while the pneumonic zone is nearer the periphery.

ACUTE PHTHISIS.—**Synonyms.**—Galloping consumption, desquamative pneumonia, etc. The condition runs a rapid course, usually terminating fatally in from six to eighteen months, dependent upon the cutting off of the air and blood supply.

Macroscopical.—The process begins at the incipient foci, peripherally or centrifugally to the air vesicle, and rapidily involves the whole lung.

The whole lung is hard, while beneath the pleura, which is thickened, especially over the apex, are seen large yellow patches, from which solid bands radiate.

Cavities are formed, the walls of which are firm, indurated and pigmented, and around which the changes are of a more acute nature, especially in the lower part of the lung; but the characteristic appearances are masked by the chronic changes.

Over the entire surface are seen the yellow patches, which become confluent at the base and thus obscure other changes.

Upon pressure a muco purulent material is exuded from the bronchi, the walls of which are thickened and gelatinous.

Microscopical.—The pleura is thickened and extremely vascular, having many granulation loops passing to the surface, while in places the pleural surfaces may be adherent.

There is evidence of an interstitial pneumonia, about which there is marked caseation, while the blood-vessels are in an advanced stage of endarteritis obliterans.

The peripheral epithelial cells are proliferated, thus infiltrating the alveoli and filling them, as well as the infundibulum, with matter. The connective tissue also becomes infiltrated with cells.

Eventually the whole lung becomes swollen, cheesy hepatization is established, and ultimately there is softening, and numerous cavities are formed.

Most pneumonias of childhood are desquamative on account of the great cellular activity present at this age.

CHRONIC PHTHISIS.—**Synonyms.**—Tubercular peri-bronchitis, chronic broncho-pneumonia, and fibroid phthisis. The lesions are similar to those of acute phthisis, but are influenced by the result of continued inflammatory processes.

The lungs are firmly adherent to the surrounding structures, especially at the apex, even to the almost entire obliteration of the pleural cavity; while the pleuræ are much thickened and fibrous, under which are seen cavities varying in size, having fibrous walls and usually containing cheesy masses.

The air vesicles are filled with fibrin and fatty epithelial cells or pus, while the walls may vary in thickness, or there may be a formation of connective tissue and new vessels.

The nodules, as in the acute form, may consist of areas of coagulated necrosis, peri-bronchial nodules, or miliary tubercles; which may either retain their characteristic structure or undergo cheesy degeneration, thereby forming cavities.

The bronchi are inflamed, which leads to the formation of new cells and the production of large quantities of mucus and pus, causing saccular or fusiform dilatation. While in the walls, which may become thickened, are found tubercle granula and granulation tissue, which may ulcerate and cause perforation. The cavities may open into each other as they increase in size.

Microscopical.—In severe cases the giant-celled systems are perfectly developed at the periphery of the nodule, while the central portion becomes caseous or fibrous, thus forming a dense fibrous mass.

The tubercle nodules follow the course of the lymphatics, as do the pigmented nodules in dust diseases.

In every chronic case the inflammatory processes are slight, the giant cells become fibroid and the process becomes quiescent.

SYPHILITIC INFLAMMATION.—Syphilitic involvement of the lungs is of difficult diagnosis. Gumma may occur or there may be fibrous bands running outward from the root of the lungs.

In inherited syphilis the gumma are usually found in the new connective tissue and generally under the pleura, becoming degenerated and consequently yellow and cheesy.

In syphilitic pneumonia we see an interstitial inflammation about the blood-vessels and bronchi at the base of the lungs, forming a dense fibrous mass. There may be ulcers of the mucous membrane or gummatous tumors.

The cavities of the air vesicles are filled with epithelial cells; the walls are also infiltrated with cells. There may be endarteritis obliterans of the pulmonary artery leading to the formation of white infarctions, around which are connective tissue zones.

Should the condition originate in utero, the air vessels become united and cannot be distended after birth.

PYEMIC ABSCESSES may occur in the lungs as a result of general pyemia, leading to the formation of abscess near the surface, associated with which there would be acute pleurisy.

GLANDERS AND FARCY may lead to infection of the lung by following the air tubes and causing fat embolism and nodules of broncho-pneumonia in the lung tissue.

ACTINOMYCOCIS.—May lead to the formation of abscesses.

Tumors of the air passages are:

Polypus.—Commonly seen in the nose, usually of cystic origin from occlusion of some of the mucous glands; they often occur as hyperplasia of the mucous membranes.

Sarcoma may be seen upon the posterior surface.

Carcinoma is rare and usually occurs as an extension from epithelioma of the face.

Fibroma occurs usually about the pharynx.

Fibrous tumors occur very frequently about the larynx, usually about the vocal cords and are frequently caused by irritation.

Epithelioma is seen growing from squamous surfaces.

LIVER.

HISTOLOGY.—The liver is composed of epithelial cells, so-called liver cells, which are imbedded in a vascular reticulum and are arranged in lobes or acini, each of which forms a unit of liver structure.

The hepatic vein may be compared to the hub of a wheel, the vessels to the spokes and the interlobular vessels to the rim.

There are three zones as follows: (1.) Outer zone (rim), portal vein. (2.) Middle zone (spokes), hepatic arterioles and capillaries. (3.) Inner zone (hub), hepatic veins.

FATTY INFILTRATION.—**Synonym.**—Adiposis of liver, lipomatosis.

Fatty infiltration is caused by a deposition of fat in the hepatic cells; the material comes from fatty food causing an excess of fat in the portal system. In a short time the fat, through exosmosis, becomes deposited in the hepatic cells surrounding the capillaries of the portal vein.

Primarily, the excess of fat is formed at the circumference of the hepatic lobules; but soon this passes from the cells on the circumference to the interior cells and eventually reaches the circulation again.

Fatty infiltration occurs as a consequence of wasting diseases, cancer, scrofula, phthisis, alcoholism or any other condition which may prevent the oxidation of the blood, such as an excess of non-nitrogenous oxidizable matter in the portal blood, or poor pressure and slowness of the circulation in portal vessels.

Phthisis may be complicated with fatty liver owing to a poor general condition.

In general, the organ is enlarged, smooth, pits on pressure, and of a pale color. The interior margin is round and thickened, while the capsule is tense and glistening.

Fatty infiltration originates in the portal zone, and there are three stages to the process.

(1.) Infiltration of fat into the outermost part of an acini. (2) "Nutmeg Liver" (advanced infiltration), the name being derived from the peculiar appearance caused by this condition. The periphery of the lobule is light in color, while the inner zone or centre, which still remains normal, is much darker in color; hence the very appropriate name, which applies rather to a contrast in color than to a fatty liver, although most nutmeg livers are fatty. Sometimes there is a hyperplasia of the interstitial tissue. (3.) The whole acini is of a uniform pale color, due to a uniform and complete infiltration of fat.

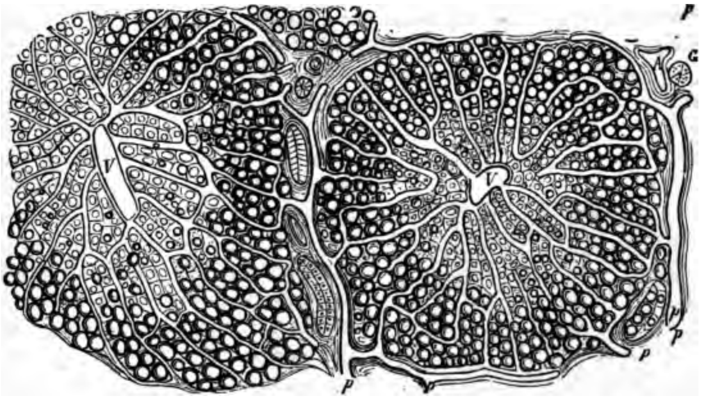

FIG. 52.—Fatty liver of moderate degree, semi-diagrammatic. (*V.*) Lumina of the central veins. (*p.*) Interlobular branches of the vena portæ. (*A.*) Arterial branches. (*G.*) Biliary ducts.

The lobule is much enlarged, and probably part of the color is caused by the anemia resulting from the pressure.

Prognosis is not bad; mild cases recover through the absorption of the fat.

ATROPHY.—(Fatty Metamorphosis).—May be divided into four classes, as follows:

(1.) **Simple or Starvation.**—A diffuse inflammation involving all the elements of the liver structure, resulting in a diminution in size of not only the organ itself, but also of the capsule, and each individual cell succumbs to the process.

As a result, the liver has a dark and shrunken appearance, and so extensive is the disintegration that it is almost impossible to discern any one element under the microscope.

The condition resembles cirrhosis, but of course in the latter condition the inflammatory process is confined to the connective tissue. Simple atrophy is due to old age or malnutrition.

(2.) **Red Atrophy or Cyanotic Liver.**—This condition is a pigmentary infiltration, associated with extensive cardiac or lung diseases.

The process begins in the central zone (hepatic vein), being caused by an over-supply, resulting from obstruction of the blood in the system. It collects in the venous side, and is forced from the vena cava into the hepatic vein, causing a dilatation of this, as well as of all connecting vessels, which pressing on the cells causes a shrivelling and consequent atrophy. A certain amount of pigment is deposited unevenly, from the vessels.

When the deposit occurs in the central zone we have a resemblance to the "nutmeg" liver; but in this condition the *dark* parts are diseased, while in fatty infiltration the *light* part is affected. The destruction in red atrophy is not uniform, and consequently the surface is uneven, especially over the course of the hepatic veins and its tributaries, where we find furrows following this vessel and its ramifications.

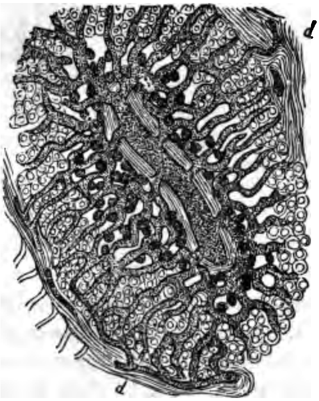

FIG. 53.—Red atrophy. (*a.*) The lumen of the vena centralis of an hepatic acinus. (*d.*) Interlobular connective tissue, increased. The remainder see in text.

In this condition the liver is firm and hard, while on section the tissue is of a dark red color, full of vessels.

(3.) **Acute Yellow Atrophy.**—(**Malignant Icterus**).—This is a true fatty metamorphosis, by many considered specific, running a rapid course, *in which the* parenchymatous substance and the cells are completely destroyed, resulting in rapid diminution in the size of the liver, which may be even folded upon itself. Primarily the central zone is of a yellowish color, while the periphery is red. In the yellow zone the cells become degenerated into a fatty mass, while in the red zone the cells are entirely destroyed and only the connective tissue and blood vessels remain. Between the two zones there is a mingling of the two colors. Normally the leucin and tyrosin is converted into urea in the liver; but in this condition it is carried to the brain, giving rise to uremia and intense nervous symptoms. The cystals are also found abundantly in the fatty debris.

This condition is found in young pregnant women or may come from septicema, septic changes, poisons (as phosphorus arsenic, etc.), or by syphilis. The organ is affected uniformly, but is soft, flabby, wrinkled and rough.

In some cases there may be a round cell, infiltration, a tendency to chronicity and possibly degeneration.

(4.) **Pressure or Circumscribed Atrophy.**—There is a diminution of a portion of the organ, due to pressure, such as results from pregnancy or tight lacing.

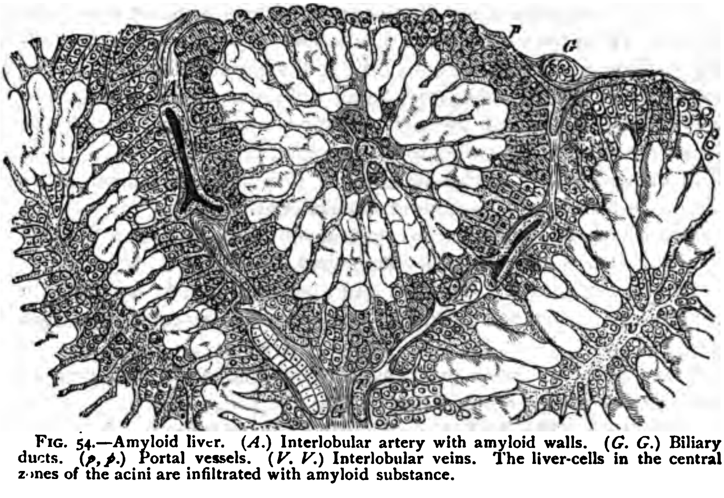

FIG. 54.—Amyloid liver. (*A.*) Interlobular artery with amyloid walls. (*G. G.*) Biliary ducts. (*p, p.*) Portal vessels. (*V. V.*) Interlobular veins. The liver-cells in the central zones of the acini are infiltrated with amyloid substance.

ALBUMINOID DEGENERATION.—Synonym.—Amyloid, bacony, lardaceous degeneration.

A condition resembling both an infiltration and a degeneration, being dependent upon two sets of circumstances: (1.) Changes in the connective tissue fibrils and basement membrane. (2.) An infiltration of these with an albuminoid matter coming evidently from the blood, in cases in which there has been caseation and suppuration.

Macroscopical.—The organ is much enlarged, the anterior surfaces being somewhat thickened and rounded. The capsule is very tense, giving a convex shape to the anterior surface. The capsule is thin, smooth and glistening. The tissues are firm, hard; pits caused by pressure disappear upon the removal of the finger.

Microscopical.—In the lobule are seen columns of compressed liver-cells, while between these are seen the capillaries, the walls of which have become waxy, degenerated, and cause a streaked appearance in the tissue. The cells of the central zone are comparatively healthy, those of the periphery being degenerated.

CONGESTION OF THE LIVER.—Congestion may be *active* or *passive*, the former occurring in "over-eaters," and is also associated with diabetes.

Passive congestion is usually the result of lung or heart complications, in which the central vein of a lobule becomes distended, leading to degeneration and atrophy, and to the condition known as *nutmeg*, *cardiac* and *cyanotic liver*, being a chronic venous congestion, which may be caused by any condition which may prevent the venous blood from returning to the thoracic cavity.

Macroscopical.—The capsule is tense, thin and translucent, while the organ is firm and tough, and somewhat atrophied.

Microscopical.—The central vein is much dilated, causing the lobules to be much more easily distinguished.

The capillaries are also dilated and filled with blood; between the capillaries are seen atrophied and compressed liver-cells, somewhat pigmented.

The walls of the veins and capillaries are thickened, and even in some cases forming fibrous bands.

ACUTE SUPPURATIVE HEPATITIS (Abscess).—A diffuse inflammation involving the connective tissue between the portal tissues. Abscess is really the only *true* acute inflammation occurring on the liver.

Abscess may be idiopathic or *metastatic.*

Idiopathic Abscess may be caused by (1) traumatism, which leads to thrombosis of a tributary of the portal vein and consequent death of the part above the obstruction; (2) from peri-hepatitis; (3) obstruction along the bile ducts.

Metastatic Abscess may be caused by (1) emboli from some vessels tributary to the portal vein; (2) emboli from some pathological condition (abscess) of the general system, passing through the lung and hepatic artery; (3) due to, or secondary to, abscess of the lung. When an embolus passes from the portal area to a lobule, we find a formation of connective tissue about the blood-vessels. Finally, the acini become obliterated and the vessels form fibrous cords; when this connective tissue finally breaks down, the abscess is established. There is hyperemia, but we never find granulation tissue, pyogenic membranes, nor is there a hemorrhagic infarction.

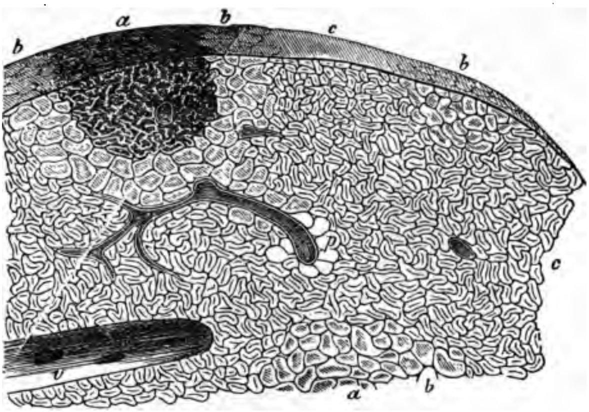

FIG. 55.—Embolic abscess of liver, after Frerichs. (*a.*) Zone of stagnation of the blood. (*b.*) Zone of parenchymatous inflammation. (*c.*) Normal parenchyma. (*v.*) Hepatic vein.

The absence of the latter is probably due to the fact that there are no endarteries and that the liver-cells are so easily packed about the vessels that it is almost impossible for them to burst; but we may have hemorrhages secondarily, for when the abscess forms around the obstructed vessel and fatty metamorphosis is fully established, there is an absorption of degenerated liver-cells, which leads to a secondary hemorrhage, when the abscess will increase by ulceration.

Liver abscesses are usually multilocular, but seldom unite or fuse,

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although they may perforate the lung, diaphragm or any neighboring structure or tissue. Occasionally the peritoneum is perforated, thereby causing a fatal peritonitis. Again, it may become caseated. However, the most common termination is an adhesion to some other organ and subsequent discharge of the contents. There may be a peculiar and distinct abscess of the liver, caused by dysentery and amebic infection; it is usually a large, single and deep-seated abscess.

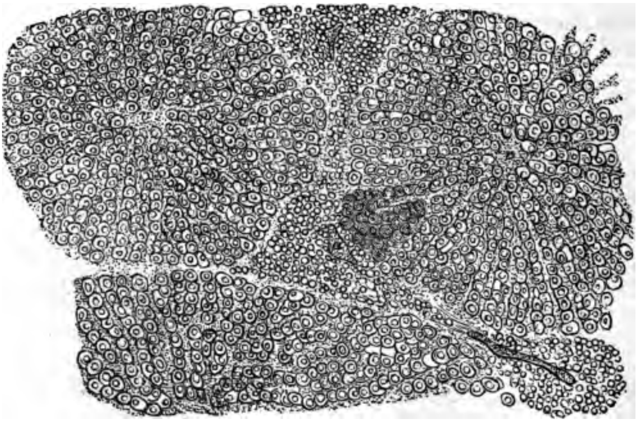

FIG. 56.—Indurating inflammation of liver, first stage. (*a*.) Lumina of interlobular vessels, in whose environs there is a small-celled infiltration. (*v*.) Lumina of interlobular vessels.

CIRRHOSIS.—**Synonym.**—Gin-drinkers', hobnail, alcoholic and granular liver.

A process characterized by an overgrowth of connective tissue, or fibrous tissue in Glisson's capsule, associated with an outwandering of white corpuscles and round-cell infiltration, the formation of new fibrous tissue, increase in the number and size of the biliary passages and atrophy and degeneration of the liver-cells.

Macroscopical.—The liver is diminished in size, is firm and leathery, while grayish fibrous bands are seen ramifying in the tissues. Near the surface the bands are continuous with the capsule; they cause the elevations and depressions seen upon the surface.

The depressions are found to be a yellow mass of degenerated cells *pushed to the surface* by the contractions in the fibrous bands.

There are two stages:

(1.) *Indurative hyperplastic hepatitis,* in which there is a wandering out of the white corpuscles and an increase of embryonic tissue, confined to the portal system.

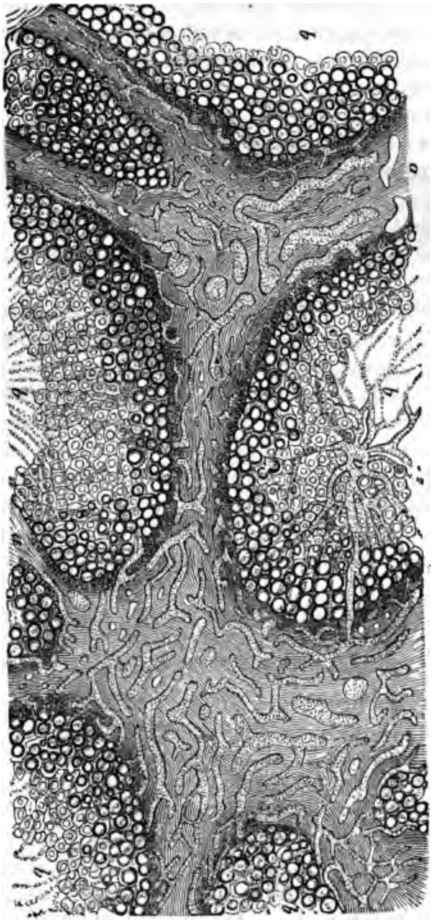

FIG. 57.—Indurating inflammation of liver, second stage. (*a, a.*) Broad stripes of a fibrous connective tissue, which is very rich in vessels without walls, and is bounded toward *b* by an interrupted layer of young connective tissue. (*b.*) Groups of acini of the liver infiltrated with fat externally.

(2.) *Atrophic hepatitis.*—Here there is an attempt at organization, in which the embryonal becomes connective tissue, which finally contracts, causing contraction in the organ. There may be several appearances of the tissues and organ, according to the degree and manner of this contraction, as follows: (*a.*) The liver becomes uniformly hard, through the complete involvement of its connective tissue; the coat is enlarged, while the cells are uniformly depressed. At an advanced, or possibly a second stage, there is a formation of granulation tissue about each acini. (*b.*) Hobnail appearance. The branches of the portal vein become enlarged and press upon the untouched lobules, causing a contraction of the connective tissue around a number of acini, which gives rise to a granular appearance, with small protrusions, to which the name "hobnail" is given.

Lobulated.—Here the connective tissue contracts in the region of the larger portal vessels. On account of the hypertrophy and pressure on the lobules, the vascularity of the overgrown connective tissue is very much increased to accommodate the blood which is crowded out of the lobules. Later, the tissue returns to a fetal condition; the lobules are about the size of a crab-apple. The cells are fairly healthy, and later, through starvation, we may have still another condition—that of a (*a*) fatty appearance, caused by disintegration of the secreting cells. Cases resulting from long-continued intermittent fever usually have a deposit of pigment. At first, where the organ is enlarged, the color is fairly good; but later, when shrinking occurs, the blood is shut off from the hepatic artery; consequently there is anemia and atrophy. As a consequence of this contraction of the liver the circulation of the portal system is obstructed, which gives rise to a dilatation of the veins on the surface of the liver and subsequent *ascites*, the result of compression on the portal vein, which throws the blood into the intestines, and, as no absorption can occur, the watery constituents exude into the peritoneum. This continues until an anastomotic venous circulation is established, either through the veins in the suspensory ligament and around the obliterated umbilical vein, or through new and distended veins in the thickened capsule. In a like manner the elimination of bile is arrested through pressure upon the hepatic duct.

"ACUTE" INTERSTITIAL HEPATITIS.—An inflammatory process resembling suppurative hepatitis, but of a less severe nature and terminating differently.

There is evidence of cloudy swelling of the parenchyma, while in the portal area there is an increased amount of blood.

Microscopical.--The leucocytes are increased about the vessels, while the capillary walls are very distinct in the portal zone. In the spaces of this zone are seen the emigrated and proliferated cells.

The protoplasm of the cells becomes fibrillated and the nuclei are prominent, many of which are those of proliferated connective tissue cells. As the formation of fibrillated tissue advances, the process becomes cirrhotic through the inflammatory and parenchymatous changes which occur.

The pressure caused by the contraction of the fibrous bands interferes with the vascular supply and consequently with the nutrition, and leads to the characteristic conditions of chronic cirrhosis.

The early stages resemble those of the suppurative hepatitis, save that the new cellular tissue becomes degenerated instead of forming fibrous tissue.

Cause.—Specific fevers, as typhoid, small-pox, measles, scarlet fever, etc.

HYPERTROPHIC CIRRHOSIS.—Synonym.—Biliary, monolocular cirrhosis.

Macroscopical.—The organ is enlarged and seldom diminishes in size. The surface is granular, imparting a rough feeling to the touch, while the tissues are hard and brittle. There is little effort at the formation of fibrous tissue; but that which does exist, incloses individual lobules and the proliferated cells remain in an embryonic state.

Microscopical.—Bile ducts are increased in number and are found passing along the fibrous tissues into the lobules. The fibrous bands, which pass at right angles, divide the lobules and cause the cells to atrophy and disappear.

Cause.—The condition is probably caused by some irritation about the bile ducts, tropical elements, etc.

SYPHILITIC CIRRHOSIS.—Congenital syphilitic cirrhosis is seen in children who are still-born or who die shortly after birth.

Macroscopical.—The liver is enlarged, firm and tough, and has nodular prominences upon the surface.

Pale areas are seen upon the surface, surrounded by yellow and reddish zones. These areas contain connective tissue and are from ¼ to ¾ inch in diameter. The lobules may be destroyed and the parenchyma may become reddish yellow in color.

Microscopical.—There is a proliferation of the endothelial lining of the capillary vessels and of the connective tissue corpuscles, lining the lymphatic spaces between the capillaries and the liver cells. The liver cells are arranged in rows and are angular and granular in appearance, while the nuclei are obscured or lost. Numerous branched connective tissue corpuscles are seen in the spaces between the liver cells and the capillary blood-vessels. Gumma are seen in the liver of cases of syphilitic cirrhosis, which are of a reddish color, containing vessels, and gradually spread into surrounding tissues.

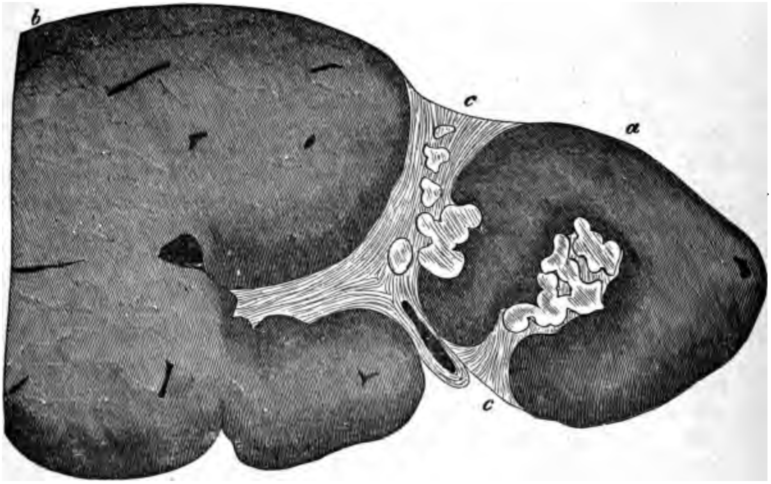

FIG. 58.—Syphilis of liver. (*a*.) Left, (*b*,) right lobe of the liver. (*c*, *c*.) Connective tissue sheath, which penetrates the organ in the direction from the porta to the lig. suspensor., and contains gummata.

They are found near the surface surrounded by a fibrous capsule, from which projections radiate into the surrounding tissues.

Cicatrices dividing the liver into small masses by fibrous bands may be seen, resulting from the above process. The fibrous bands extend from the Glisson capsule and contain many small gummata.

TUBERCULOSIS is well demonstrated in the liver, because of the absence of catarrhal conditions, which occur in the lung *tissue.*

Tubercle nodules occur on the capsule or near the surface as gray or caseous granulations, which soon become caseous.

The tubercle follicles appear in the interlobular or portal areas, the small bile ducts become involved and bile is poured into the mass, imparting a greenish color.

TUMORS.—Cysts may be of various forms and may be associated with cystic degeneration of the kidney.

Simple serous cysts are caused by pressure.

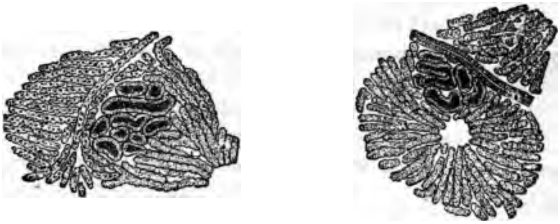

Fig. 59.—Adenoma of the liver. Smallest nodule produced by the partial metamorphosis of an acinus.

Adenoma is one of the common primary growths, may be multiple and is usually near the surface.

Cystic Adenoma is larger than the simple form, is multiple, and grows from the mucous glands of the bile ducts.

Primary Cancer is rare, but it occurs frequently as a secondary growth.

Primary cancer may appear as circumscribed rounded masses, or it may be diffused, in which cases the cancer nests are found in the meshes of the connective tissue, or there may be a tendency toward the formation of cancer nests about the portal vein.

Secondary or metastatic cancers occur as circumscribed nodes. Three-fourths of all cancers of the liver are secondary, while two-thirds of these are secondary (arising from emboli) to cancer of the stomach. Others may be secondary to the growths in the breast or uterus.

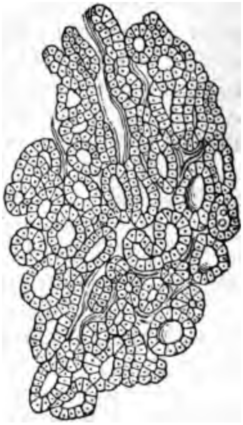

Fig. 60.—Adenoma of the liver. Tubular structure of the tumor.

Sarcoma is rare, especially of the primary form.

Angioma occurs frequently, usually of a cavernous type, and is found in elderly people, apparently not affecting the functions of the organ.

BILIARY PASSAGES (**Biliary calculi**) are caused by the stagnation or obstruction to the flow of bile into the intestines.

They are usually found in the gall bladder, but may occur in other parts of the passages. They are of a greenish color, round when occurring single; and flattened upon the surfaces, from pressure, when multiple. Calculi lead to inflammation, ulceration, and in some cases to perforation. Inflammatory conditions of the biliary passages are common. The catarrhal process may be an extension from other tissues, causing swelling and accumulations of mucus, which may lead to obstruction, jaundice and other sequelæ.

In more severe cases there may be ulceration and suppuration and possibly septicemia.

KIDNEY.

HISTOLOGY.—The kidney is composed of tubules, blood-vessels and a small amount of connective tissue. Each tubule commences in the malpighian capsule, which contains a nest of blood-vessels called "glomerulus." Primarily the tubule is tortuous and convoluted, so long as it remains in the cortical substance, then it becomes straight and passes to the medullary substance. Here it turns upon itself and constitutes the so called loop of Henle, then joining the collecting tube, and terminates in the pelvis of the kidney. The epithelium is squamous in the malpighian capsule and loop of Henle. Columnar in the tortuous and straight collective tubes. The tubule is composed of connective tissue and basement membrane, upon which the epithelium rests.

The capillaries which enter the malpighian capsule and form the glomerulus are derived from the renal artery. These run parallel with the tubule and are called the " vasa recta."

Again these prominent branches which run transversely between cortical and medullary substances are called " vasa transversalis."

The veins are quite prominent in the cortex, and form little cavities called stellate veins.

The malpighian bodies, which are about the size of a small pin head, can be seen by the naked eye.

The connective tissue is found principally in the capsule, although there is some in the medullary portion, between the tubules, while very little is found in the cortical portion.

ABNORMALITIES.—Absence of one kidney, usually the left, may occur; the right kidney becomes hypertrophied and may have two pelves and ureters, or the ureter may be traced into a mass of connective tissue on the side which has no kidney.

Kidneys may be very large. Small kidneys always contain an abundance of connective tissue and should not be confounded with atrophy.

Floating Kidneys are caused by an increased length of perineal covering. The kidney is liable to become twisted and dilated, causing hydronephrosis.

This condition is usually found in women, principally upon the right side.

Lobulated.—In this form, which occurs in fetal life, both kidneys may be symmetrically lobulated. The capsule is not adherent.

Horseshoe Kidney.—Both kidneys are united by bands of connective tissue, either at lower, middle or upper ends. These kidneys are usually found low down in the pelvis, and commonly have two ureters and two pelves.

TUBE CASTS.—These bodies indicate lesions of the kidney, and may be composed of—(1.) Degenerated epithelium. (2.) Urinary deposits or secretions. (3.) Materials resulting from hemorrhage into the tubule or glomerulus. (4.) Materials foreign to the tubule.

Hyaline Casts.—Are seen in health as well as in acute conditions. They are moulds of tubules, and consist of coagulated serum; albumen, derived from the glomerular capillaries. They are homogeneous and form the basis of nearly all the casts.

They occur in the looped and collecting tubules, and are difficult of recognition unless stained.

Epithelial Casts.—Among these forms, the colloid cast is the more common; it is a yellowish translucent cast, occurring in all cases in which there are extensive epithelial changes, as in interstitial nephritis and waxy kidney.

They have a hyaline body covered with epithelial cells and leucocytes, and are usually found in the looped or straight tubules.

Granular Casts.—Composed of a hyaline body, surrounded by the *protoplasm* of degenerated epithelial cells. They are larger than the ordinary hyaline casts, and are found in the convoluted tubules in inflammatory or atrophic changes of the epithelium.

The granules may unite, forming small drops and giving us fatty casts.

Casts formed from Urinary Deposits.—Usually consist of crystals of acid urate of soda, as seen in granular contracted kidney.

Similar conditions are seen in children who die soon after birth, due to the rapid production of uric acid, which cannot be held in solution by the urine, and becomes deposited in casts

Casts resulting from Hemorrhage.—These blood casts are seen in acute nephritis, resulting from scarlet fever, and consist of—in acute cases—slightly altered blood corpuscles. As the condition becomes more chronic in nature, there is pigmentation.

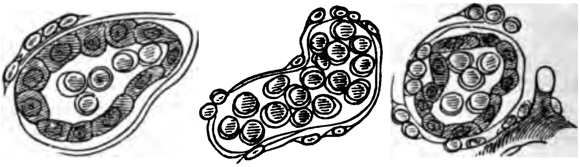

FIG. 61.—Transverse and oblique sections of catarrhal urinary tubuli.

Casts formed from Foreign Materials.—May be composed of bilirubin, occurring in cases of jaundice, or calcareous casts, may be found in elderly people.

Kidney diseases may be classed as follows—(1.) Conditions which result from defective circulation. (2.) Conditions causing changes in the epithelium. (3) Conditions causing changes in the connective tissue.

The two latter groups, being of an inflammatory nature, are characterized by the presence of tube casts and other inflammatory products, in the urine.

Conditions due to defective circulation :

ANEMIA.—This condition, which is rarely met, should not be mistaken for fatty degeneration. In the latter condition the cells are fatty, while in anemia they are at first normal, but later become degenerated. Again, in fatty degeneration the kidney is enlarged, while in anemia it is small and pale.

Anemia, which may be *general* or *local*, is caused by hemorrhage, pressure on the organ or renal artery, or any condition which may diminish the blood supply, as cholera, etc.

Localized Anemia is due to emboli or thrombi.

ACTIVE HYPEREMIA.—This condition, which gives a cloudy swelling of the cells, is more commonly seen than anemia, and is caused by such poisons as cantharides, phosphorus, etc. When of short duration the process usually terminates in recovery, but if continued for a long time, it may lead to parenchymatous infiltration.

PASSIVE HYPEREMIA.—Chronic venous congestion, cyanotic congestion, or induration. This condition is more commonly seen than any of the above conditions.

Macroscopical.—The kidney is enlarged, firm and elastic. The capsule is not adherent, while the stellate veins lying underneath it, are distended. The cortex is smooth, congested and of a purple color, due to the contraction of the veins.

The malpighian bodies are prominent and arranged in rows each side of the distended interlobular veins.

In the medulla, where the changes are conspicuous, the vena recta are very prominent, especially around the congested bases of the pyramids.

Microscopical.—The interlobular veins, capillaries, etc., are filled with colored blood corpuscles.

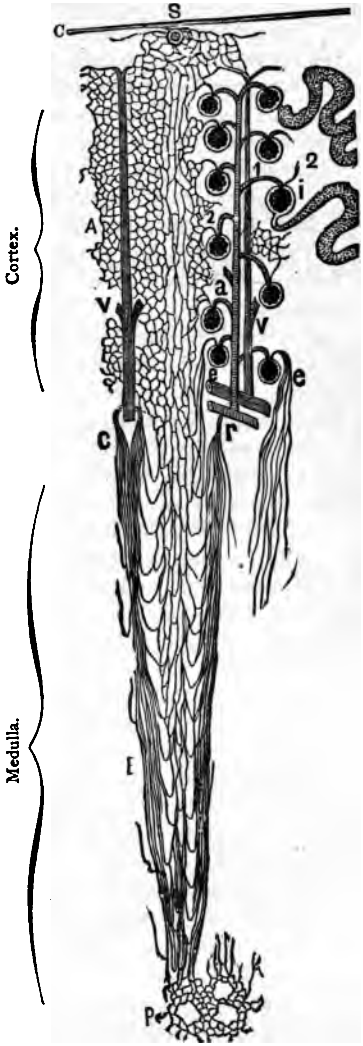

FIG. 62. – Blood-Vessels of the Kidney. (*A.*) Capillaries of cortex; (*B.*) Of medulla. (*a.*) Interlobular artery; (1.) Vas afferens; (2.) Vas efferens; (*r*, *e.*) Vasa recta; (*VV.*) Interlobular vein; (*S.*) Origin of a stellate vein; (*i*, *i.*) Bowman's capsule and glomerulus; (P.) P of papilla; (C.) Capsule of kidney; (e.) Vasa from lowest vas efferens.

The epithelium is granular, while small globules of fat are seen in the protoplasm of the cells, which may occasionally fill the tubules.

There may be wedge-shaped areas of fibrous tissue under the capsule, the apices of which extend into the cortex, while the bases face and are near the surface.

Cause.—Such conditions as cause obstruction to the flow of blood, as valvular diseases, especially mitral complications of the heart, alcoholism, bronchitis, phthisis, etc.

The inflammatory conditions affecting the kidney are divided as follows—(1.) Those which occur about the blood-vessels and in the connective tissue. (2.) Those occurring in the malpighian bodies. (3.) Those affecting the tubules.

When an inflammatory condition affects the connective tissue there may be an infiltration into the lymph spaces of lymph and white blood corpuscles, causing distention and clogging the spaces.

In more advanced or chronic cases there is a proliferation of the endothelial cells covering the fibrils, which leads to an increase in the connective tissue between the lobules.

ACUTE PARENCHYMATOUS NEPHRITIS. — **Synonyms.** Cloudy swelling of the parenchyma; tubular or catarrhal nephritis.

Macroscopical.—The kidney is enlarged, round and flabby, having a hard and smooth surface. The capsule is loose, pulls off easily, leaving a shining, pale and edematous surface.

The cortex is increased, and usually presents evidence of hyperemia. The malpighian bodies are conspicuous.

The cortex is lighter than the medulla; but through the medium of blood extravasation, it may present a mottled appearance.

Microscopical.—We find that the principal changes occur in the cortex, which is pale and opaque.

The pyramids appear small, and the Bertini columns seem shrunken, while the medullary rays are prominent.

The epithelial cells lining the convoluted tubules are much swollen and irregular, pressing the blood out of the capillaries between the tubules and imparting an anemic appearance to the tissues. When the process has existed for some time, a few fat globules may be seen in the cells, obscuring the nucleus and leading to the impression that the cloudy swelling is being supplanted by fatty degeneration.

In more advanced cases there may be hemorrhage into the cortex, *giving hemorrhagic* parenchymatous nephritis.

Cause.—Scarlet fever, small-pox, diphtheria, or acute and general infectious conditions, poisons, pregnancy, etc.

Mild acute parenchymatous nephritis terminates in recovery. In fatal cases the glomerulus becomes involved and inflamed.

GLOMERULAR NEPHRITIS.—This condition is simply a parenchymatous inflammation, in which the flat epithelium, covering the Bowman capsule and extending over the malpighian bodies, is affected.

The glomerulus becomes filled with proliferated epithelium, part of which may become degenerated.

CATARRHAL OR DIFFUSED NEPHRITIS.—An inflammatory condition of the parenchyma, in which the discharging tubes of the pyramids and medullary rays are especially affected.

Desquamation of epithelium, in the form of casts, occur in a parenchymatous inflammatory process, involving the convoluted tubes and glomeruli; there may be swelling and degeneration, but not desquamation. Again, the latter condition is the result of some vascular condition; while catarrhal or diffused nephritis is usually an extension from neighboring structures.

CHRONIC PARENCHYMATOUS NEPHRITIS. — **Synonym.** Large white kidney. This synonym is not correct, inasmuch as the waxy kidney is of a paler color than this kidney.

Macroscopical.—The kidney is enlarged, though proportionately light in weight.

The cortex is swollen and peels off easily, and in diffuse cases is light in color, while in other cases it is mottled.

Malpighian bodies are conspicuous, the pyramids dark and the medullary rays prominent.

Microscopical.—Fatty globules are found in the degenerated epithelium of the cortex and convoluted tubules, some of which become shriveled up after losing their epithelium. There is also an increase in the connective tissue, resulting from an interstitial inflammation, which is caused by the parenchymatous process.

Numerous fatty and colloid casts are seen in the lower part of the convoluted tubules.

Cause.—Specific or other febrile conditions, poisons, etc. The process is usually rapid, save when there is present an interstitial condition.

INTERSTITIAL NEPHRITIS.—May be of two forms:

(I.) **Embolic or Septic.**—Due to metastasis or emboli, occurring at the periphery, is multiple and conveys its poison through the blood.

(2.) **Pyronephritis.**—Involves the pyramids, as a result of extension upward, from traumatism, gonorrhœa, cystitis, stone or catheter injuries, or it may result from inflammatory conditions arising in the urinary passages, usually in connection with abscess of the pelvis of the kidney. These abscesses become very large, involve considerable tissue and usually destroy the organ.

HYDRONEPHROSIS.—A condition in which there is obstruction to the flow of urine, arising from these same causes or in connection with them, is often seen.

Interstitial nephritis usually occurs as a sub-acute or chronic process.

CHRONIC INTERSTITIAL NEPHRITIS.—**Synonym.**—Chronic sub-acute, chronic contracted kidney, granular, red granular, cirrhotic or gouty kidney. The process may be (1) *localized*, when, occurring after syphilis as a reparative process; connective and scar tissue is formed and leads to a contraction or "puckering" of the organ. (2.) The *diffused* form occurs as a slow, progressive and usually fatal process, in which the kidney becomes contracted.

Macroscopical.— Early in the progress the kidney is usually slightly enlarged, firmer than normal and of a reddish color. The capsule may be somewhat thickened and adherent.

The cortex is rarely thickened. The tissues are firm, dense and translucent, while the malpighian bodies are not particularly prominent.

The artery walls are thickened, rigid and prominent. Later in the process the organ is contracted, the capsule thicker and more adherent, leaving upon removal a granular and rough surface.

Microscopical. –There is an overgrowth of connective tissue which forms concentric circles about the malpighian bodies. There is also a general cellular infiltration. The Bowman capsule is much thickened and fibrous, while the glomerular tuft is not discernable.

Cysts may be seen containing a clear, yellowish fluid, which may have a tendency to coagulate or become gelatinous. The cysts are lined with squamous epithelium, and are formed by an obstruction in the uriniferous tubules.

There is a thickening in the walls of the arterioles, probably caused *by an effort on the* part of the vessel to exclude the irritating blood.

As a consequence of this resistance there is usually hypertrophy of the heart. This, as well as other symptoms of this condition, is very obscure, and is seldom discovered except by accident or when uremia occurs. The pyramids are seldom seriously involved, and there is little albumen in the urine, but waxy casts which usually indicate a chronic process, as well as a polyuria, are present. In parenchymatous nephritis the fibrous tissue manifests itself secondarily, while in the red granular kidney the primary process leads to a marked increase in the fibrous tissue. While in both forms there is a predominance of either hyperplasia of the connective tissue or degeneration of the epithelium.

Cause—Alcohol, uric acid, rheumatism, gout, inflammatory conditions, poisons, old age or general conditions, which may lead to an arterio-sclerosis or induration of parenchymatous organs.

SUPPURATIVE NEPHRITIS.—Synonym.—Suppurative pyelonephritis, disseminated nephritis, multiple abscess. A condition occurring as a result of extension from such inflammatory processes as stricture of the urethra, cystitis, calculi, etc.

Macroscopical.—The kidney is irregularly enlarged, soft and friable, while the capsule peels off easily, and small abscesses may be seen in the cortex and pyramids, These abscesses may coalesce or communicate with the pelvis of the organ, causing pyronephrosis. Perinephritic abscess results when the process invades surrounding structures.

Microscopical.—Quantities of granular material are seen along the interlobular arteries, surrounding the malpighian bodies and between the tubules, and is most marked at the base of the pyramids. The epithelium lining the tubules becomes granular and degenerated.

The process may be associated with ulcerative endocarditis, in which case the multiple abscesses result from impaction of septic emboli in the intraglomerular or intertubular capillaries and the interlobular vessels.

TUBERCULOSIS may occur as (1.) *disseminated or acute miliary tuberculosis*, which occurs frequently as a part of a general tuberculosis, in which the kidney involvement occurs late, and does not amount to a great deal. (2) *Tuberculous pyelo-nephritis*, which may be a special lesion extending from the pelvis, and even causing death.

Macroscopical.—The general appearances are not much changed; but on removing the capsule small granulations of a wedge-shape, projecting above the surface and extending into the cortex, are seen, while nodules of fibrous tissue are found in the centre of the pyramids.

Microscopical.—The nodules are seen following the course of, and in the perivascular sheaths of the interlobular arteries. Each nodule is composed of several tubercular follicles, in the centre of which can be seen granular caseous patches, even in the early stages, when very little is distinguishable save the masses of small round cells and an occasional endothelial cell, near the centre.

The typical giant cells may be rarely formed before caseation occurs.

CYSTS.—A chain of cysts may be formed when the convoluted or straight tubules become irregular, tortuous or varicose.

They are found in granular kidney, in the tubules near the wedge-shape area.

Cysts may also be formed by the distention of Bowman's capsule of the malpighian bodies, the orifice being stopped up either by some foreign mass or by the constriction of fibrous bands. Cysts may contain serum, which is derived from the blood. Colloid material comes from degenerated epithelium and urinary deposits.

CONGENITAL CYSTS occur during fetal life, in which cases the kidneys, both of which are involved, may be small or much enlarged. The cyst originates as a distended tubule or glomerulus, but finally occupies nearly the entire organ.

Cysts are found during life occupying the kidneys, which have become enlarged and filled with cysts of varying sizes. The fluid contains albumen, cholesterin blood pigment, etc., giving rise to various appearances and colors.

TUMORS.—Primary tumors are lympho-sarcoma and small, round-celled sarcoma, which may be congenital, and are often combined with myxoma or rhabdomyoma.

Sarcoma leads to extensive enlargement of the organ.

Fibroma occurs as small fibrous nodules, usually occupying the centre of the pyramids, but may occur in other parts.

Adenoma usually originates in the collecting tubules. Cancer occurs in the cortex, ultimately infiltrating the whole organ, which *becomes very large.*

HEMORRHAGIC INFARCTION occurs in the cortex of the kidney as a result of lodgment of fragments, usually from the left side of the heart.

CALCULI.—Calculi are caused by accumulation of various chemical products in the pelves or calyces of the kidney, and may be as follows:

Uric acid calculi occur as gravel or small, round, smooth masses, of a reddish or brown color; they occur in great quantities, and are composed of a mixture of uric acid, urate of soda and other alkaline urates. Calculi, having a rough surface and filling the pelves and calyces, contain phosphates in addition to the uric acid and urates.

Carbonate of lime calculi are hard and of a yellowish color. These calculi are found in the kidneys of elderly people, and are composed largely of carbonate of lime.

Oxalate of lime calculi are small "mulberry masses," smooth, hard and of a purplish color; they are soluble in mineral acids.

Phosphate of lime calculi occurs as small, smooth, nodular masses, of a soft and friable consistency, and white in color.

Cystine calculi are of a yellowish color and occur as ovoid crystalline masses, which are soluble in ammonia; they are rarely seen.

Xanthine calculi, like the above, are rare, but may be found, resembling waxy masses, which are soluble in hot nitric acid, which, upon evaporation and the addition of potash, give a violet color.

Biliary calculi occur in cases of icterus, especially in newly-born children.

The pigment may be found deposited in granules in the epithelium of the tubules, or may occur as distinct calculi, composed of crystals of bilirubin or bile pigment.

Triple phosphates of ammonia and magnesia occur, deposited upon inflamed surfaces or upon any of the calculi.

	URINE.		ALBUMEN.	CAST.	PROGNOSIS.	
	COLOR.	Q'ANTITY.				
Acute Nephritis. Synonym—Catarrhal, desquamative, tubular, parenchymatous nephritis.	Smoky, Dark and Bloody.	Greatly Diminished.	Considerable, about 5 per cent.	Narrow, hyaline, epithelial and bloody.	Favorable.	Kidney is of a deep red color, enlarged, cortex increased, and the capsule is not adherent.
Chronic Nephritis (early stages.) Synonym—Parenchymatous, large white kidney, diffused nephritis.	Pale and Smoky.	Normal.	About 2 per cent.	Hyaline, bloody, epithelial, dark and granular.	Unfavorable.	Kidney has smooth surfaces, is much enlarged, of a white color and indurated. Capsule is not adherent.
Chronic Nephritis (late stages.) Synonym—Parenchymatous, contracted or fatty kidney.	Pale.	Increased.	About 1 per cent	Compound fatty, granular, epithelial	Bad.	Kidney about normal size, of a pale yellow color, surface uneven, capsule adherent, often find cysts.
Chronic Interstitial Nephritis. Synonym—Contracted, red granular, cirrhotic or gouty kidney.	Very Pale.	Greatly increased.	May be absent.	Pale, granular and waxy.	Very bad.	Kidney of a reddish or brown color, contracted beyond normal size; capsule is strongly adherent, cortex diminished; cysts are usually present.
Mitral Disease.	High color and sp. gr.	Scanty.	Moderate amount.	Hyaline slightly granular.	Varies.	The Liver is enlarged. There are evidences of arterio-capillary fibrosis, which also occurs in late chronic interstitial nephritis. There is history of rheumatism or some infectious disease; no uremia; mitral murmur.

LYMPHATIC SYSTEM.

HISTOLOGY.—A lymph gland is composed of two portions—the medullary and cortical; the former contains the lymph cords and paths, while the cortical portion contains the lymph follicles or cortical nodules and lymph sinuses. The lymph nodes are so placed in the course of the vessels that the lymph passes through them and is filtered in the process.

The follicles are continuations of the cords, while the sinuses are continuations of the lymph paths.

The former contain the blood-vessels, while the latter act as lymphatics, through which the lymph is carried to the larger vessels. This condensed network of connective tissue contains many loops of blood-vessels, and when forming the centre of an alveolus is called a lymphatic cord or nodule. Surrounding this is a looser network of connective tissue, called the lymph paths.

Lymphatic tissue is prone to become involved in any inflammatory process which may be established in any of the neighboring organs or tissues. The process may terminate as inflammation does—in resolution, suppuration, etc.

The amount of lymphatic tissue belonging to one body is not by any means a fixed quantity; in some cases there may be more than twice as much as in another.

A system may be so filled with this tissue that a Peyer's patch might extend continuously along the intestines.

The function of the lymphatic glands is the formation of white corpuscles, and as there is no wall between the lymphatic vessels and the loose reticulum of connective tissue, the white corpuscle wanders out very easily.

LYMPHANGITIS.—An inflammatory process of the larger lymphatic vessels, and usually secondary to some traumatism.

The walls of the vessels, as well as the surrounding tissues, become infiltrated with pus cells, while the lumen contains desquamated epithelium, pus and fibrin. There is considerable hyperemia and pain, even in remote vessels. The process usually terminates in resolution, and the vessel assumes its normal functions, or the process may terminate in abscess or the formation of new connective tissue, causing an obliteration of the lumen.

TUBERCULAR LYMPHANGITIS.—This process involves both the small and large vessels, in which miliary tubercle and tubercle tissue is seen along the walls extending into the lumen in the large vessels and filling the lumen in the smaller ones.

This process may exist independently, but is usually an extension from some other tuberculous involvement.

SYPHILITIC LYMPHANGITIS may be seen in vessels about primary syphilitic ulcers. There may be thickening of the walls of the vessels, with sometimes the formation of gumma in them.

DILATATION—LYMPHANGIECTASIS.—This condition may be congenital, or it may be caused by any pressure causing an obstruction to the flow of lymph.

Lymphangioma is sometimes composed of a circumscribed collection of dilated vessels.

In macroglossia and elephantiasis the lymph vessels are always dilated.

LYMPH GLANDS OR NODES (Acute Inflammation).—This condition usually occurs secondarily to some neighboring process in which the tissues become red, swollen and soft.

There is an increase in number of small, spheroidal and mixed cells, sinuses, follicles and cords, and swelling in the endothelial cells of the reticulum of the sinuses.

The blood-vessels may be dilated with blood or there may be small hemorrhages into the follicles and sinuses.

The process may terminate in resolution or it may be intense, leading to suppuration and the formation of abscesses (as seen in *buboes*), which may open internally or externally, or they may become cheesy, which may become calcified and inclosed in connective tissue.

Chronic inflammation leads to an increase in connective tissue elements and the gradual disappearance of the lymphoid cells. The entire nodule may become a connective tissue mass, the formation of which begins with thickening of the reticulum of the follicles and sinuses.

The condition is seen in the bronchial nodes, probably as a result of continued inflammatory conditions.

Aside from a general cheesy degeneration occurring in the glands of scrofulous subjects, there may be tuberculous and syphilitic degenerations.

Tuberculous processes may occur as simple degeneration, leading to cheesy changes, and may be local, or it may be part of a general *miliary tuberculosis*.

The nodes become enlarged, swollen and hyperemic, usually softer than normal, and finally terminate in cheesy degeneration, while the tubercle themselves, instead of becoming cheesy, may be converted into a hyaline material or may become fibrous.

Syphilitic processes occur, associated with general syphilitic processes. In primary stages the immediate glands are involved, while in secondary forms remote glands are infected, as the axillary glands, etc. In the third stage gummatous enlargements may occur in the glands.

TUMORS.—Sarcoma occur as primary or secondary tumors, and may be small or large, round or spindle-celled or angio-sarcoma. Carcinoma are secondary, the nature and variety of which depends upon the nature of the primary tumor.

SPLEEN.

HISTOLOGY.—The spleen is of a lymphatic nature, and the only organ which has brown pigment normally.

A section of this tumor should not be mistaken for melanotic sarcoma. In the latter the cells are large and distributed, while in the spleen the cells are round and thick, having lymphoid and muscular tissue.

The reticulum of the spleen is compared to a sponge. About the organ is a capsule, which is a serous reflection of the peritoneum, which sends trabeculæ into the organ, dividing the interior into spores, which latter are penetrated by divisions of the splenic artery; but the malpighian bodies are not well supplied with blood.

We may have active or passive hyperemia of the spleen, but never inflammation.

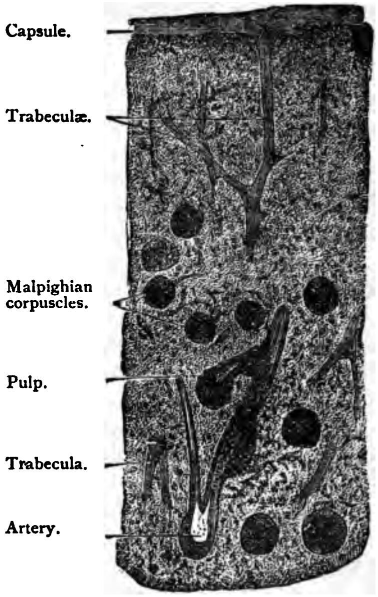

FIG. 63.—T.S. Part of the human spleen. Müller's fluid, hæmatoxylin, × 10.

The spleen filters the blood, manufactures red and white corpuscles, and also destroys the red corpuscles.

ACUTE HYPEREMIA.—This occurs physiologically after eating; pathologically, it occurs with diphtheria, typhoid and scarlet fevers and pyemia, etc.

When associated with malaria and typhoid, the condition gives rise to the so-called "splenic tumors."

There is simply an enlargement of the spleen without very much change histologically, save that there is marked multiplication and proliferation of the endothelial cells, leucocytes, etc., and the tissues are dark in color, due to the debris and the dead red corpuscles.

The spleen is enlarged, softened, and, when the process is intense, the capsule may be ruptured.

In the enlargement resulting from malaria the malpighian bodies are not involved; but when resulting from typhoid fever or diphtheria, they are usually affected, there being an infiltration of bacteria.

PASSIVE HYPEREMIA occurs when there is obstruction in the liver or heart, as disturbances in the portal circulation or valvular heart disease.

The constant hyperemia causes connective tissue hyperplasia, leading to the thickening of the capsule and trabeculæ.

"Cyanotic spleen" is caused by the contraction of this newly-formed connective, giving rise to a small and contracted organ.

CHRONIC HYPEREMIA comes from malaria and gives rise to a general pigmented appearance of the body, the pigment being derived from the spleen.

EMBOLISM AND THROMBOSIS.—Primary thrombosis never occurs in the spleen, but often results from embolism, which is very commonly seen in the organ from the fact that there are many end-arteries in the organ and that the splenic artery receives the blood directly from the heart.

Hemorrhagic infarction is the first stage of embolism. This imparts a dark red color to the area, the base of which is toward the surface.

In the second stage there is degeneration of the red blood corpuscles, contraction of the tissue and a fatty degeneration of the colorless blood corpuscles. In the third stage we have a puckering caused by a contraction of the cicatrices.

If the emboli should be infectious there is an intense irritation which leads to metastatic abscesses, which vary in size from that of a millet seed to that of an apple. They usually terminate fatally. Abscess of the spleen may also result from rupture into the spleen of a gastric ulcer, or from the extension of a suppurative process in the neighboring tissues.

LEUKEMIC SPLEEN.—A hyperplastic enlargement of the spleen in which not only the organ, but the malpighian bodies, are filled with blood giving rise to a mottled appearance. This hyperemia and enlargement may be so extensive as to lead to rupture of the organ. There is little change in the surface save that there may be depressions in places, caused by tension on the trabeculae.

In the second stage, the malpighian bodies are still more enlarged, especially in cases in which the reticulum and cells are overgrown.

Stagnation, atrophy and pigmentation of the splenic pulp occurs.

In the third stage, there is great enlargement of the granular matters at the expense of the pulp.

AMYLOID DEGENERATION.—Consists of a circumscribed or diffused process. In the former case there is an albuminous infiltration affecting the malpighian bodies, which become enlarged and give rise to the condition known as "Sago Spleen."

In the diffused form the pulp is involved. The blood-vessel walls become infiltrated, and there is general hypertrophy. Later both the pulp and the malpighian bodies are involved.

PIGMENTATION.—Is caused by the destruction of red corpuscles and is formed in infectious conditions, malaria, etc.

ATROPHY.—Is sometimes found in elderly people.

TUMORS.—It is doubtful if a primary growth ever occurs in the spleen; but there may be secondary tumors as sarcoma, carcinoma, angioma and cysts, especially the ecchinococcus.

THYROID GLAND.

The thyroid is a racemose *ductless* gland, being composed of spherical and separate alveoli, which are filled with an albuminous material.

GOITRE OR STRUMA.—This consists of an enlargement of the old tissues and a formation of new gland alveoli, which process is often accompanied by colloid degeneration.

SIMPLE HYPEREMIA may cause considerable enlargement and annoyance, but seldom leads to any serious symptoms. Goitre, of which there are several forms, as soft. fibrous colloid and calcareous, originates in a hyperplasia of the follicles of the acini.

In Soft Goitre there is a hyperplastic enlargement of the follicles, which are sub divided into smaller areas, each one of which forms new follicles. The enlargement is uniform, usually containing a semi-fluid material which often leads to a pseudo-fluctuation.

Fibroid Goitre is hard, like a fibroid tumor. The process affects the intercellular connective tissue. The alveoli are not uniformly affected; some are pressed and destroyed, while others are merely enlarged.

Colloid Goitre resembles other forms, save that the acini are enlarged and the albuminous material is supplanted by one of a colloid nature, which may be formed by a degeneration of the cells of the albuminoid material. The acini finally become united, until one or several large cysts may be formed, giving rise to cystic stroma, in which case the walls of the alveoli are degenerated and atrophied.

The acini, which are glassy and filled with fluid, can be separated one from the other.

Limy or Calcareous Goitre.—Here there is calcification, and through maceration a perfect skeleton may sometimes be formed.

Aneurismal Goitre (*telangietatic struma*, *cavernous angioma.*) The blood-vessels, with which the gland is richly supplied, are chiefly affected. They become very much enlarged and contribute a pulsation to the sense of touch.

TUBERCULOSIS sometimes occurs in the connective tissue of the gland.

TUMORS.—Cancers may form in the epithelial linings of the gland.

SUPRARENAL CAPSULES.

HISTOLOGY.—These bodies are semi circular shaped organs, and, like the thyroid, are covered by a capsule and consist of a medullary and cortical portion. The latter is composed of follicles, lined with fat and epithelial cells, while towards the centre of the medullary portion the character of the follicle is lost.

It was to this body that Addison, in 1855, called attention to a condition, or, as Virchow says, a series of conditions of a probable neurotic origin, the pathological changes of which consist of cheesy degeneration, forming spots which may be as large as a marble subsequent softening of the mass and thickening of the capsule.

TUBERCULAR INFLAMMATION occurs frequently, in which case the bodies become enlarged, while the surface may be smooth or nodular. The structure of the gland is destroyed, and we find connective, tubercular tissue and cheesy material.

GOITRE OR STRUMA SUPRARENALIS may be hard or soft and causes enlargement of the follicles.

HEMORRHAGE into the body causes bloody cysts, and usually occurs in children shortly after birth. Cysts may also be formed by softening.

AMYLOID INFILTRATION affects only the blood-vessels of the medulla.

THROMBOSIS may occur in the cortex, of a capillary nature.

TUMORS.—Cancer and sarcoma may occur primarily or secondarily.

Glioma, which is not rare, may cause an extensive enlargement of the organ.

NERVOUS SYSTEM.

Theoretically the diseases of the brain and cord would be:

PACHYMENINGITIS.—(1.) *External osseous*, which is a thickening of the external layer of the dura mater, associated with hyperplasia of the bone. (2.) *Internal osseous*, usually involving the falx cerebri. (3.) *Purulent*, usually caused by infective wounds of the skin or extensions of middle ear diseases.

THROMBOSIS may occur in the sinuses, as a result of extension of inflammatory processes from neighboring structures.

Intermeningeal hemorrhage occurs as a result of traumatism, and comes from the veins which extend from the arachnoid into the sinuses. Hemorrhages from any of the above are called hematoma of the dura, while the product or remains of a hemorrhage is called *hygroma*.

EDEMA of the membranes of the brain is caused by obstruction, by tumors or valvular heart disease, and leads to accumulation of liquid in the meshes of the pia, or between the arachnoid and pia mater.

The arachnoid, unlike other serous membranes, has no fibrinous exudate upon its surfaces.

ACUTE ARACHNITIS OR LEPTOMENINGITIS is usually the result of emboli from erysipelas, peritonitis, pneumonia, typhoid, etc.

BASILAR ARACHNITIS AND LEPTOMENINGITIS may be syphilitic, tubercular or part of a cerebro-spinal meningitis.

CHRONIC SUPERFICIAL ARACHNITIS AND LEPTOMENINGITIS rarely occurs, and may be *fibrous*, in which there is uniform thickening, *osseous*, in which plates are formed.

PACCHIONIA.—In which there are circumscribed thickenings.

CHRONIC, DEEP ARACHNITIS OR ENCEPHALO-MENINGITIS.—A condition in which both the nerves and membranes are involved, and occurs in general paresis.

DURA MATER.

Inflammations of the Dura Mater are called *pachymeningitis*, and may be internal or external, acute or chronic, all of which lesions usually affect the surface, though the substance of the Dura Mater may be involved.

ACUTE PACHYMENINGITIS EXTERNA may result from injuries or diseased conditions of the cranial bones. The Dura Mater is congested, softened and thickened, and may become ecchymosed.

Later suppuration may occur, with the formation and accumulation of pus in the membrane, or between it and the bone.

There may be thrombosis of the venous sinuses, and even gangrene may occur.

The process may be localized and terminate in resolution, or it may be diffused, involving the inner surface of the dura, the pia mater and brain. There is usually a hyperplastic condition of the bone associated with this process.

ACUTE PACHYMENINGITIS INTERNA may follow the external form, or may occur associated with some infectious condition in which there is an exudation of yellow pus and fibrin, which may be general or circumscribed, and which lines the internal surface of the membrane.

CHRONIC PACHYMENINGITIS.—A process in which new connective tissue is formed in the Dura Mater, causing thickening and its adherence to the bone. The thickening may be general, involving the entire membrane, or it may be localized. Occasionally osteophytes are seen, being small masses of bone adhering to the skull and formed by ossification in the external layer.

PACHYMENINGITIS HEMORRHAGICA INTERNA. — A chronic inflammatory process involving the inner layer of the dura, in which layers of connective tissue are formed, containing a number of delicate blood-vessels, from which there is frequently hemorrhage or the blood escapes by diapedesis.

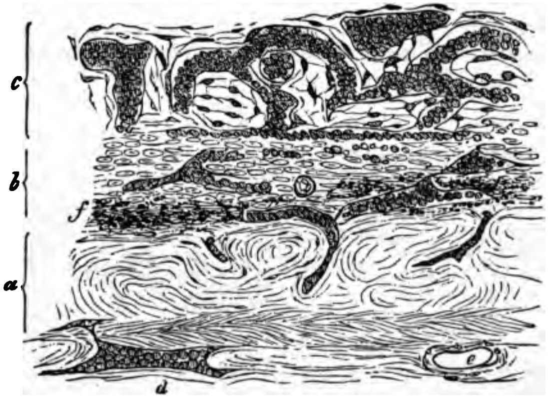

Fig. 64.—Pachymeningitis chronica hæmorrhagica. Vertical section through the dura mater, and an efflorescence of the same of several layers. The dura mater, which contains a venous vessel without proper walls, and an artery, is not more minutely designated. It is intimately connected with the oldest layer of new membrane. (*a.*) The latter simulates it even histologically. (*b.*) Next oldest layer consisting of spindle-celled and round celled tissue, separated from *a* by a strip of pigment *f*, *c*. Most recent efflorescence very vascular, separated from *b* by a thin layer of blood corpuscles.

TUBERCULAR PACHYMENINGITIS may occur as part of a general process, or it may be an extension from a similar process affecting the pia mater or bones.

SYPHILITIC PACHYMENINGITIS is manifested by the formation of gummata upon both surfaces of the dura mater and may be single or multiple. They may suppurate, leading to the formation of abscess, or the inflammatory process may extend to the pia mater, causing a simple or infectious inflammatory process or adhesions between the pia and dura mater.

TUMORS of the Dura are Sarcoma, especially the spindle-celled variety, which grow from either surface. Epithelioma grow inward or outward and cause pressure upon the brain substance.

Fibroma, lipoma, chondroma and osteoma occur rarely.

PIA MATER.

Inflammation of the pia mater are called meningitis or leptomeningitis.

ACUTE MENINGITIS.—This condition occurs associated with cerebro-spinal or typhoid fever and kidney or lung diseases, or it may result as an extension from some inflammatory process occurring in neighboring structures.

The process frequently extends and involves the pia mater of the cord or the ependyma of the ventricles, especially in young children.

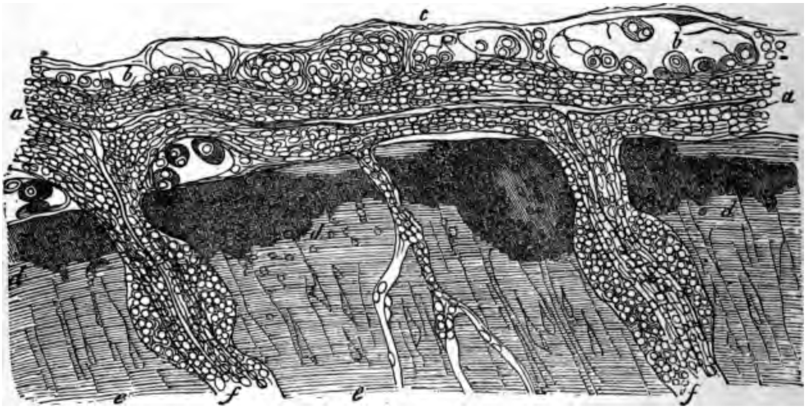

FIG. 65.—Vertical section through the pia mater and the contiguous portion of the cortex of brain in tubercular meningitis. (*a*, *a*.) A larger vessel of the pia mater, whose entire sheath is inflammatorily infiltrated. (*b*, *b*.) Lymph-spaces of the pia mater with commencing tubercular proliferation of the endothelia. (*c*.) Miliary tubercle of the pia mater. (*d*.) Outermost layer of cortex of brain infiltrated with round cells. (*e*.) Normal brain substance. (*f*, *f*.) Proper cerebral vessels in a state of tuberculous degeneration.

ACUTE CELLULAR MENINGITIS.—This condition occurs as a productive process. There is a general production of cells extending over the entire surface of the brain.

SIMPLE ACUTE MENINGITIS.—This process is of a exudative form and is characterized by the accumulation of pus, serum and fibrin in the meshes of the pia mater and along the walls of the blood-vessels. White blood corpuscles are seen, adhering to the *blood-vessels, or even* clogging them.

There may be accumulation of pus between the pia mater and the brain substance, which may compress the convolutions, while the cortical portion may be infiltrated with serum and become edematous or degenerated.

CHRONIC MENINGITIS.—The process may be confined to portions of the brain, as the apex or base, or the whole surface may be involved. The pia mater is thickened, associated with which there is a formation of new connective tissue, pus, serum, fibrin, etc.

The process occurs as a result of traumatism or neighboring inflammatory processes, or it may be associated with alcoholism, nephritis, or general paresis.

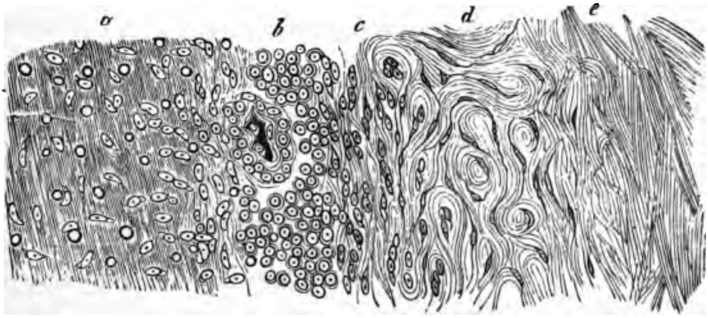

FIG. 66.—Solitary caseous nodule, so-called tubercle of the brain. (*a.*) Normal white brain substance. (*b.*) Proliferating layer of germinal tissue of the tubercle, inclosing a thickened vessel. (*c*, *d*, *e.*) Fibroid metamorphosis of the germinal tissue, at the same time the border zone of the caseous tumor.

TUBERCULAR MENINGITIS.—In this process, which is usually part of a general tuberculosis condition, miliary tubercles are seen in the pia mater, associated with an exudative inflammatory process, which may also involve the dura.

Aside from the usual phenomena, there are scattered miliary tubercle, which are especially conspicuous at the base of the brain.

The condition is frequently called acute hydrocephalus, because of the distention caused, especially in the ventricles, by the excessive amount of serum present.

There is a general proliferation of cells about the blood-vessels, along the course of which are seen the tubercular granulations, which accumulate around the vessel and distend the perivascular sheaths. The tissues may finally become cheesy and degenerated.

SYPHILITIC MENINGITIS.—In tertiary syphilis gummata are seen involving the membranes and cerebral cortex, especially near the base of the brain.

These growths, which are surrounded by a fibrous capsule, may be single or multiple, involving primarily the membranes, but extending to the cortex. The pia mater is greatly thickened, while accumulations of small round cells are seen about the vessels. The cell masses may become degenerated, leaving nothing but a mass of granulation tissue.

HYDROCEPHALUS.—May occur in adults. The cause of which is not understood perfectly, though it is known to occur associated with tubercular conditions.

The ventricles are dilated, though never to such a degree as in congenital hydrocephalus.

CONGENITAL HYDROCEPHALUS.—This condition may be hardly evident, or occur in an advanced stage of development at birth. The process may progress, killing the child, or it may remain quiescent. All the ventricles, as well as the central canal of the cord, may be involved, and the distention may be so great as to cause the brain tissue over the vertex to be destroyed or crowded up into a thin membrane beneath the dura mater, and as a result of this dilatation we find the convolutions much flattened and even obliterated, in cases.

SECONDARY HYDROCEPHALUS.—Occurs usually in children as the result of some inflammatory process of the brain, as acute, chronic or cerebro-spinal meningitis, or of alcoholism or general paresis. The dilatations of the ventricles and tissues are not so great as in the congenital form, nor is the shape of the skull of the characteristic hydrocephalic form.

VENTRICLES OF THE BRAIN.

The ventricles of the brain are in communication with the lymph spaces of the pia mater, and yet an inflammatory process in one does not necessarily involve the other; for instance, the ventricles may be dilated with fluid, while the pia mater might be very dry; on the other hand, the pia mater might be edematous when the ventricles contain only a normal amount of fluid.

Accumulations of fluid within the ventricles are sometimes called *internal hydrocephalus*, in contradistinction to accumulations in the meninges, *external hydrocephalus.*

ACUTE EPENDYMITIS.—This condition usually occurs associated with some other inflammatory lesion of the brain, in which the ependyma is congested, thickened, and infiltrated with pus cells; the surface is covered with fibrin and pus, while the vessels are tortuous and prominent.

Ecchymosis may be seen in the tissues, while the ventricles may be filled with purulent serum.

This condition, as well as other forms of inflammation, usually involve the lateral ventricles, and occasionally affect the fourth ventricle or choroid plexus.

Tubercular ependyma is occasionally associated with tubercular meningitis.

CHRONIC EPENDYMITIS.—This condition is more common than the above form. The ependyma is thickened (diffusely or regularly) and white, consequently the vessels are invisible. The appearance of the surfaces varies, sometimes being smooth, while at others it is rough and granular. The ventricles may be enormously dilated, or the sides of the ventricles may be adherent and grow together by the adhesion of the roughened and thickened ependyma.

BRAIN SUBSTANCE.

ANEMIA.—May be local or general, and dependent upon general anemia or disturbances of the circulation, or valvular heart disease (mitral stenosis or regurgitation), or obstruction from pressure, emboli, thrombi, etc.

The brain is also anemic when there is a hydrocephalic condition of the ventricle, or an edematous condition of the membranes.

HYPEREMIA.—As in the case of the pia mater, may be caused by epilepsy, delirium tremens, poisons, and infectious diseases.

EDEMA.—May accompany either anemia or hyperemia, and is dependent upon causes which lead to these conditions.

THROMBI.—These may occur in the arteries, as a result of any degenerative or inflammatory process in the walls, which gives rise to inflammation of the intima, causing its roughening and destruction.

Thrombi may also form about an emboli, provided the latter does not occlude the artery.

EMBOLI of the cerebral arteries usually arises from endocarditis or cardiac thrombi, or atheroma or aneurism of the aorta.

Large emboli from endocarditis may completely occlude a large artery, causing death. On the other hand, in terminal arteries the obstruction leads to degenerative and softening changes in the brain tissue.

This condition may exist for some time, it may be supplanted through absorption by a connective tissue cicatrix, or a wall may form about the area, leading to the formation of a cyst, or the mass may become hard and dry.

CEREBRAL HEMORRHAGES.—May result from increased pressure within arteries which have become fatty degenerated or thickened.

Hemorrhage occurs most frequently in the corpus striatum, optic thalamus and internal capsule, less frequently in the white substance of the convolutions, pia mater, cerebellum, pons varolii and medulla oblongata.

When cysts occur as a result of embolic softening no blood crystals are found in the sac walls; there is simply a fatty degeneration of the tissues, leaving a mass of granular debris and fat, with an increase in the leucocytes.

When the softening is due to thrombosis and the stoppage is gradual, there is true fatty degeneration and yellow softening.

Red softening of the brain is an inflammatory process leading to fatty degeneration, in which there is marked congestion of the vessels. In this condition there are hemorrhages into the perivascular sheaths, etc.; exudation of leucocytes and proliferation of the neuroglia cells.

TUMORS.—Sarcoma, epithelioma, fibroma, lipoma and myxoma.

APOPLECTIC AREAS are caused by the running together of many capillary hemorrhages resulting from traumatism, pressure or rupture of degenerated arteries.

ENCEPHALITIS (Abscess).—Small, multiple abscesses occur with pyemia.

Large abscesses are usually single, and occur under different circumstances, and may be non-capsulated; it is simply a cavity containing pus and softening brain tissue, but having an irregular outline.

The encapsulated abscess has a capsule of connective tissue, inside which we find pus, either thin or cheesy. Outside the walls, which are ragged and infiltrated with pus, the brain tissue is softened and edematous.

An abscess near the lateral ventricles may rupture into them; when near the pia mater, may cause meningitis, or near the sinuses of the dura mater may cause thrombosis.

Abscesses are caused by inflammatory conditions of the ear or nose, or traumatism.

CHRONIC INTERSTITIAL ENCEPHALITIS (Sclerosis.)—This process may be limited to small areas, or it may involve a whole lobe and consist of an increase in connective tissue elements and neuroglia, while the nerve elements, especially the ganglionic cells and medullary sheaths of the nerves, are atrophied. There is granular and fatty degeneration and the formation of corpora amylaceæ and Gluge's corpuscle.

Diffuse sclerosis results from alcoholism.

Circumscribed Sclerosis—Multiple Sclerosis.—This form is more frequently seen than the diffuse form, and may be associated with a sclerosis of the cord or may exist independently in the brain.

The areas, which are white or grayish, are usually confined to the medullary portion, and become about the size of a pea.

SYPHILITIC INFLAMMATION.—Gumma may be found near the periphery of the brain; they are circumscribed and usually connected with the meninges.

The outside of the tumor is usually fibrous, or there may be an infiltration of small spheroidal cells, while the central portion is usually cheesy. This condition may lead to endarteritis obliterans.

TUBERCULAR INFLAMMATION.—We find small, circumscribed masses of new tissue occurring singly or multiple, usually in the cerebellum of young people, and usually associated with a tuberculous condition in some other tissue.

The tubercles are usually single, and consist of a thin, central, cheesy mass, around which is a grayish zone of tubercle granula, small spheroidal and large polyhedral or giant cells.

They may break down, in which case they resemble simple abscesses.

ATROPHY occurs in alcoholism, opium or lead poisoning, chronic meningitis or insanity, or sometimes as a senile change. It also occurs in children, associated with a general atrophy.

The cerebral hemispheres and the nerve elements are usually involved.

HYPERTROPHY rarely occurs, and is congenital. Perforation of the neuroglia sometimes leads to hypertrophy. The white substance is increased in amount. The dura and brain substance is anemic, while the convolutions are flattened and the ventricles small.

TUMORS.—Glioma—These vary in size, and are found in the cerebrum, usually circumscribed, soft and of a grayish color; when of a white color, they are usually hard.

The blood-vessels are dilated and often lead to hemorrhage, and are subject to fatty and cheesy degeneration.

Sarcoma, which occur primarily or secondarily, may be associated with glioma.

Angioma, myxoma, lipoma, fibroma, osteoma, endothelioma (cholesteatomata) are large, glistening, white tumors.

Carcinoma occur secondarily.

SPINAL CORD.

Diseased conditions of the spinal cord are classified as follows: (1.)

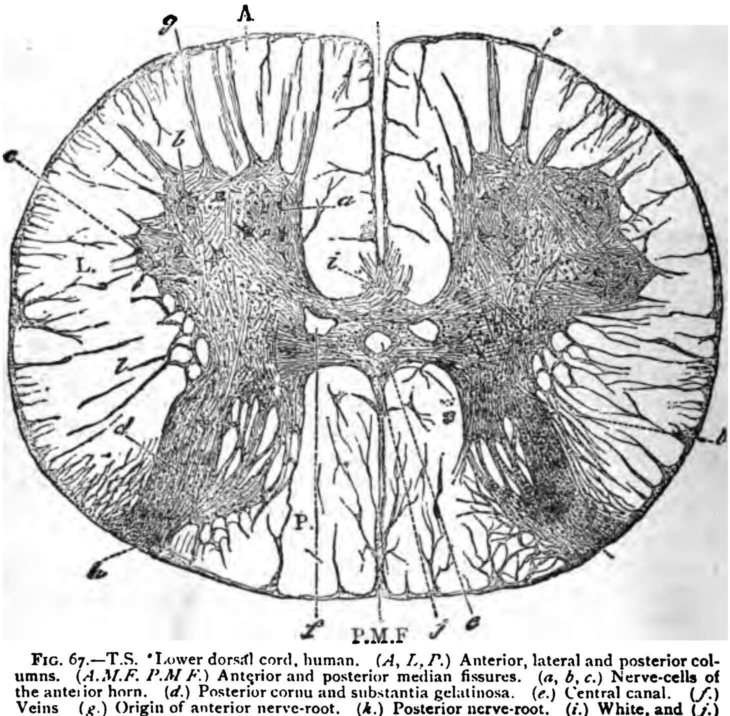

FIG. 67.—T.S. 'Lower dorsal cord, human. (*A*, *L*, *P*.) Anterior, lateral and posterior columns. (*A.M.F. P.M F.*) Anterior and posterior median fissures. (*a*, *b*, *c*.) Nerve-cells of the anterior horn. (*d*.) Posterior cornu and substantia gelatinosa. (*e*.) Central canal. (*f*.) Veins (*g*.) Origin of anterior nerve-root. (*k*.) Posterior nerve-root. (*i*.) White, and (*j*.) Gray commissures. (*l*.) Reticular formation.

Inflammation of the meninges. (2.) Inflammation of the gray matter, or poliomyelitis, in which changes are established in the ganglionic cells, especially those of the anterior horn. (3.) Atrophy, primary or secondary, of the tissues of the gray matter. (4.) Primary inflammation of the white matter. (5.) Secondary degeneration of the white matter.

INFLAMMATION OF THE MENINGES resembles closely similar processes affecting the cerebral membranes; but the process is usually associated with an inflammatory condition of the surface of the cord; later, there is secondary inflammation of the periphery of the white matter of the cord and of the connective tissue of the nerve roots, which leads to secondary degeneration.

INFLAMMATION OF THE GRAY MATTER (Poliomyelitis).—This condition occurs in early life, and is due to hemorrhage or great increase of blood in a small area, associated with edema.

There is inflammation of one or both of the anterior horns of the gray matter and atrophy of that portion corresponding to the parts involved, while the cords and horns are atrophied on the affected side.

DESCENDING GRAY DEGENERATION.—A condition affecting the motor nerve fibres, having a variable course and finally passing into the ganglionic centres.

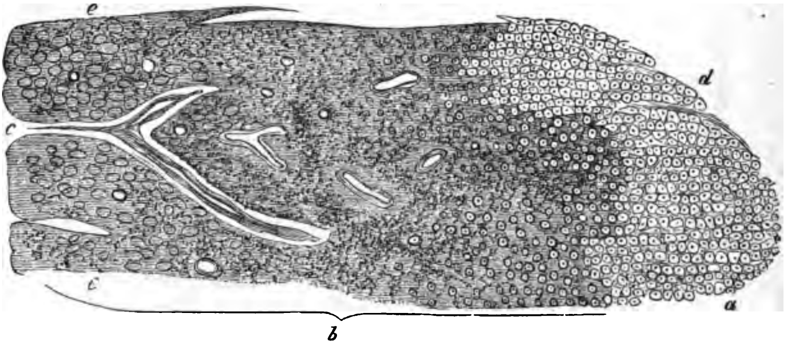

FIG. 68.—General view of gray degeneration. In part after Fromann. (*a.*) Normal parenchyma of the spinal marrow. The light figures are the cross-sections of nerve-fibres. (*b.*) The territory of the gray degeneration. (*c.*) A vascular cleft with a vessel. (*d*) Boundary toward the gray substance (posterior horn). (*e.*) Periphery of the column of the spinal cord, richly infiltrated with amyloid corpuscles.

The condition is caused by any lesion of the brain, such as softening from emboli or apoplectic areas, which may interfere with any of the motor nerve-fibres, originating in the central convolutions and leading to gray degeneration of the nerve-fibres outside the lesion, usually in the posterior part of the lateral columns of the opposite side. Again, a lesion below the medulla causes a gray degeneration on the same side, lower down.

ASCENDING GRAY DEGENERATION.—A degeneration of the central ends of the fibres, associated with an overgrowth of connective tissue about them, caused by a lesion interfering with the course of the sensory nerves in the cord.

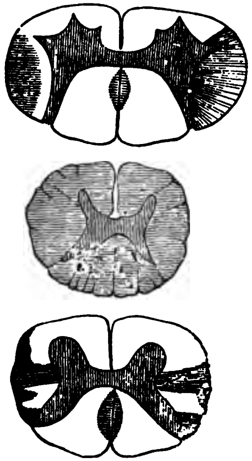

FIG. 69.—Unusual localization of simple gray degeneration. In the cervical and lumbar portion of the spinal marrow (the upper and lower figures), the lateral columns particularly are affected; in the dorsal portion (the central figure), the entire medulla. After Fromann. Natural size. Cross-sections.

Degeneration of the entire posterior column, the cerebellar tract and a portion of the column of Gower, results from a lesion of the cord, involving or destroying the centripetal fibres.

INFLAMMATORY CONDITIONS.—**ACUTE MYELITIS.**—Sometimes called transverse myelitis, because the process is confined to a small longitudinal area of the cord.

At the point of involvement the cord is softened and fattened.

The blood-vessels are dilated, while the cells and nerve-fibres are swollen. The degenerated material may be absorbed, resulting in the formation of cysts or cicatrices, while in mild cases the functions of the parts are restored.

Ascending and descending secondary gray degeneration may be associated with this condition.

ACUTE DISSEMINATED MYELITIS.—An inflammatory condition involving the entire cord, which is congested, swollen and infiltrated with cells, while the nerve elements are degenerated. The process has a rapid course and kills in a short time.

ANTERIOR POLIOMYELITIS.—A series of inflammatory *conditions involving* the anterior gray horns. The condition is usually found at the lumbar or cervical regions, but may be scattered. There is atrophy, degeneration and pigmentation of the ganglionic cells of the anterior gray horns, as well as an increase in the connective tissue, in the anterior and lateral columns and gray horns.

CHRONIC TRANSVERSE MYELITIS.—A condition in which there is a formation of connective tissue and atrophy of the nerve elements of the gray and white matter, caused by pressure upon the cord. The cord becomes hard and atrophied at the point, and the condition may lead to ascending or descending gray degeneration.

MULTIPLE SCLEROSIS.—A condition resembling and usually associated with similar conditions of the brain in which there are formed numerous scattered and circumscribed areas of connective tissue, probably originating from the neuroglia. Associated with this formation there is degeneration and atrophy of the nerve-fibres and ganglionic cells.

The areas may be large or small and may involve both the white and gray matter.

POSTERIOR SPINAL SCLEROSIS.—(**Locomotor Ataxia.**)—In this condition there is an increase in the connective tissue, with a degeneration and atrophy of the nerve-fibres in the posterior columns of the spinal cord; usually in the dorsal or lumbar enlargements.

There may be involvement of the lateral columns and the anterior horn.

The process may extend upwards and involve the restiform bodies; but when the cervical region is involved, the process is usually confined to the column of Goll.

Microscopical.—There is considerable new connective tissue, composed of neuroglia cells and delicate fibres, while the blood-vessels are thickened.

AMYTROPHIC LATERAL SCLEROSIS.—A progressive muscular atrophy, associated with spastic contraction. There is degeneration of the ganglionic cells of the anterior cornua and the anterior and lateral pyramidal tracts; this degenerative material is replaced by neuroglia tissue. The process is seen in the cervical enlargement and causes atrophy of the hands.

BULBAR PARALYSIS is an extension of this process to the medulla, in which the different centres become involved.

PRIMARY LATERAL SCLEROSIS.—A condition said to involve the lateral pyramidal tracts without involving the anterior cornua.

TUMORS.—Cysts may sometimes occur, either from softening or other causes.

Gumma and tubercle are rarely seen.

Fibroma and Sarcoma are found in the meninges, of the alveolar type.

Glio-sarcoma and glioma are encapsulated and resemble swollen brain substance, except that it is darker, gelatinous and hemorrhagic.

Neuroma, carcinoma and other tumors of meninges may involve the cord secondarily.

SYRINGOMYELIA.—A condition in which a cavity is formed about the central canal of the spinal cord, usually of the upper part.

The lesion usually consists in the formation of a gliomatous or glio-sarcomatous tissue, which becomes disintegrated and leads to the formation of cavities in the substance of the cord. The cavities are usually filled with fluid and may become quite large, in which case there is usually involvement of the anterior or posterior cornua and posterior columns.

HYDROMYELIA.—(**Hydrorrachis interna**).—A congenital malformation in which the central canal of the spinal cord is dilated by a fluid. The process may be so extensive as to leave merely a shell of the cord. The cavity is lined with epithelial cells.

Hydrorrachis externa.—A condition in which there is an accumulation of fluid between the meninges of the cord, leading to atrophy of the cord.

Hydromyelocele.—Spina-Bifida.—A condition associated with hydrorrachis in which there is imperfect closure of the spinal canal posteriorly, which allows the fluids to form a distending sac which may be covered by skin, or the skin may be absent and possibly rupture may occur.

The walls of the sack consist of the pia and dura mater which become fused. In cases of hydrorrachis externa, only the dura mater would be present in the sac wall.

Within the sac may be seen a lateral division of the cord, or there may be a shell of distending nerve tissue.

The openings into the spinal canal may be attributed to a rudimentary formation or absence of the vertebral arches, or when the arches are completely formed, the sac may protrude through them.

PERIPHERAL NERVOUS SYSTEM.

DEGENERATION of the peripheral nerves occurs when the fibres are separated in any way from the trophic centres; but occasionally they may become regenerated and assume their normal functions.

Cause.—Section of nerves, traumatism, pressure from dislocation of bones and other causes. Anterior poliomyelitis, poisons, as dipththeria, alcohol or lead poisoning, etc. The degenerative process resembles that of the cord, consisting in the degeneration of the axis sheath into droplets, which become decomposed, forming fat, which may remain free, or enclosed in cells and finally become absorbed.

If conditions are favorable the divided ends of the nerve may be united, a new formation in and about the severed portions may occur and the function become restored.

NEURITIS.—A degeneration of nerves in which there is degeneration as well as proliferation of the connective tissue in the nerve.

ACUTE EXUDATIVE NEURITIS.—An acute inflammation of the nerves, in which the nerves are swollen, red and infiltrated with pus cells.

The process may terminate in gangrene and destruction of the nerves, or it may become chronic and lead to the formation of new connective tissue, or it may terminate in resolution.

The process is caused by injury, or it may be secondary to some inflammatory process in the vicinity.

CHRONIC INTERSTITIAL NEURITIS.—A chronic interstitial inflammation resulting from an increase of connective tissue in the nerve sheath and intrafascicular bands.

The nerve-fibres become atrophied by pressure and the axis cylinder and medullary sheath are more or less involved and destroyed.

MULTIPLE NEURITIS.—A degeneration of the nerve-fibres occurring in various portions of the body, often accompanied by proliferative changes in the neurilemma cells.

The condition is caused by over-exertion, exposure to cold or dampness, alcohol, arsenic, lead, etc. Occasionally the process is of an exudative type, leading to the formation of new cells, occurring within and between the nerve-fibres.

LEPROUS INFLAMMATION occurs as a formation within the nerves of masses of a newly-formed tissue, resembling granulation tissue, and containing the leprous bacilli and leading to the condition known as *Lepra anesthetica.*

SYPHILITIC AND TUBERCULAR INFLAMMATIONS may occasionally exist at the nerve ends, associated with similar conditions of the meninges.

TUMORS.—Neuroma, true and false; myxoma and rarely sarcoma.

FEMALE ORGANS OF GENERATION.

PERITONITIS.—The peritoneum lining the pelvis is often the seat of an inflammatory process which leads to adhesions and alterations in the arrangement of the parts, especially of the fallopian tubes and ovaries.

Beneath the peritoneum is a loose layer of connective tissue which is especially abundant about the cervix and uterus.

The tissue contains an abundance of lymphatics and is frequently inflamed, giving rise to conditions known as pelvic cellulitis and parametritis, which may, through continuity, extend even up to the ureters of the kidney. This condition may lead to suppuration and abscesses, which may open into the bowel or bladder or vagina—rarely into the peritoneum.

METRITIS may be *acute* or *chronic.*

Acute Metritis.—There is an acute inflammation of the connective tissue stroma, leading to a purulent infiltration of the uterine walls. The organ is swollen and congested, and there may be small hemorrhages into the walls and cavity of the uterus.

Chronic Metritis results from acute metritis, or is associated with acute or chronic endometritis. There is an increase in the quantity of the embryonic elements throughout the whole muscular wall, especially prominent about the blood-vessels, and followed by a development and consequent contraction of connective tissue about the vessels and lymphatic spaces, leading to dilatation of the latter.

The uterus is enlarged, the walls of which are congested and thickened.

PERIMETRITIS.—An inflammatory condition involving the peritoneal covering of the uterus, leading to the production of pus and membranous adhesions, which may be small or extensive, and may lead to displacement of the pelvic organs. The process usually accompanies endometritis, and is very common in prostitutes.

PARIMETRITIS.—A suppurative inflammation involving the connective tissue about the uterus, between the organ and the duplications of the peritoneum.

ACUTE CATARRHAL ENDOMETRITIS.—An inflammatory condition of the endometrium, in which there is swelling and hyperemia of the mucous membrane and occasionally punctiform hemorrhages.

The body of the uterus may be swollen, while the cells are swollen and granular. The epithelium may become desquamated.

The surface is covered with a muco-purulent exudation in which there are a great many spheroidal cells. The capillaries are dilated with blood.

The condition is caused by abortion, gonorrhœa, infectious conditions etc.

CHRONIC ENDOMETRITIS.—This condition may follow the acute form or begin as a chronic condition, in which the mucus membranes may be swollen, congested, markedly thickened and covered with a muco-purulent exudation.

The thickening causes the surface to become rough and papillary or polypoid, which (the mass) upon removal may lead to an erroneous diagnosis of adenoma.

The mucous membrane may be dark in color from pigmentation with extravasated blood.

The condition leads to softening, shedding of the epithelium, and finally destruction of the glandular elements of the mucosa.

The process may extend to the vagina and fallopian tubes, while the canal of the cervix may become contracted and obliterated.

The condition may be caused by injuries, malnutrition, displacements and tumors.

CROUPOUS ENDOMETRITIS.—Is a rare condition occurring in the puerperal uterus in acute infectious conditions, as cholera, typhoid, exanthemata, etc.

The condition may exist with a croupous inflammation of the colon, and may involve the vagina and fallopian tubes.

SYPHILITIC ENDOMETRITIS.—This condition leads to the formation of ulcerations and condylomata of the mucous membrane of the cervix.

TUBERCULAR ENDOMETRITIS.—Usually occurs as a part of a general tubercular process of the genito-urinary tract, in which the cavity of the uterus is lined with a yellow cheesy material involving the walls of the organ.

Miliary tubercle are seen at the edges of the mass or scattered through the mucosa.

TUMORS.—Fibroma is rare, but fibro-myoma or myo-fibroma are commonly seen.

"Papillary Fibroma" occurs frequently, growing from the mucous membrane, in which there is a vascular reticulum covered by epithelium.

The surface may be smooth and villous, or it may contain glandular follicles resembling adenoma or carcinoma.

Polypus of the uterus occurs commonly, and may be large or small, single or multiple.

Sarcoma may occur as a primary growth in the mucous membrane, either as a circumscribed nodular growth or as a diffuse infiltration. They lead to hemorrhage and gangrene and usually recur.

Carcinoma of the cervix may be of three forms, of which the more common is simply (*a*) an infiltration of the tissue by the cancer masses. (*b*) There may be cauliflower growths, fungoid excrescences of an epitheliomatous nature. (*c*) A condition limited largely to involvement of the mucous membranes.

Cancer involving the body of the uterus rarely occurs, although it is sometimes seen in advanced life, occurring as nodes or polypoid growths involving the mucous membranes.

OVARIES.

Inflammation and cirrhosis of the ovaries may occur in almost any form, from a mild acute condition to that of fibrous tissue formation. These processes follow the usual courses pursued by such conditions.

The organs vary in size, which is influenced by the menstrual period or the violence of the inflammatory process.

CYSTIC DEGENERATION.—Cysts are frequently seen in partially cirrhosed ovaries, and resemble the multiple cystic degeneration, which leads to the formation of "ovarian tumors," and with which this condition should not be confounded.

TUMORS.—Adenoma.—Cystic adenoma, "compound ovarian cyst" occurs more commonly than any other tumor. The condition consists of a fibrous stroma containing tubular follicles, lined [illegible]h cylindrical epithelium. These follicles usually become filled [illegible]th fluid, causing dilatation and leading to the formation of cysts.

There may be many such cysts or there may be a few follicles greatly dilated, forming a " multilocular cyst," or the cyst walls may become absorbed and large cysts form.

Fibroma, leio-myoma, sarcoma and carcinoma are occasionally seen.

BACTERIA.

In 1680 the attention of scientists was first drawn to the subject by Leuwenhoeck, of Holland. He, by means of simple biconvex lenses, demonstrated the presence of micro-organisms in the feces and saliva of man, as well as in portions of the vegetable and animal kingdom.

It was nearly a century after the discoveries of this man before the subject was again agitated. This time (1786), by Otto Müller, who made use of a compound microscope in the study of these organisms.

This man divided the bacteria into two classes, *monods* and *vibrios.*

After this period there seems to have been considerable enthusiasm enlisted, for we find several scientists working upon the subject, among whom were Lamarck, 1816; Brugiere and Saint Vincent, 1824; but even though these men devoted considerable time to the work, they accomplished very little which was not given out by Müller.

In the year 1833 Ehrenberg did some very good work, demonstrated in his book upon the subject, in which he makes a classification which he terms "vibrionia," being "filiform animals without intestines, without external organs and naked, united in chains or filiform series, the result of an incomplete spontaneous division."

This group he divided into the following sub-divisions or genera.

Bacteria.—Small rods, straight and rigid, without vacillating motions.

Vibrio.—Filiform bodies, susceptible to undulatory motions, such as those of an eel or snake.

Spirillum.—Filiform bodies in a strong helix.

Spirochetae.—Bodies in a helix, forming a flexible string.

Next, in 1841, comes Dujardin, of Paris, who in his work upon the subject, modifies Ehrenberg's views, making three sub-divisions of the latter's four, uniting the spirillum and spirochetae into [illegible] class.

In 1850 Royer and Davaine referred to the presence of rod-shaped bacteria in the blood of sheep, which had succumbed to a disease known as "sang de rate" (splenic fever).

It was the presence of the micro-organism in this connection which made Pasteur famous, and thus the story is told up to a time when Pasteur achieved success with his investigations and prophylactic treatment of conditions affecting sheep and silkworms.

Next comes Koch, of Berlin, who in 1875 describes the sphero-bacteria of cholera, known as the comma bacillus of Koch; later he described the desmo-bacteria of tuberculosis, to which he gave the name of bacillus tuberculosis.

Since this period he has devoted much time to the perfection of a prophylactic for this condition, but up to the present time nothing absolute has been found.

Owing to divers opinions regarding the classification of bacteria, it is almost impossible to combine them into any single table, inasmuch as many authorities base their classifications upon physiological, while others confine themselves to a morphological consideration; however, there can be no doubt but that these micro-organisms belong to a fungi, of a low order, of the vegetable kingdom.

Bacteria may therefore be defined as a group of the lowest form of plants, resembling algæ.

Formerly they were called fission or cleft-fungi, or schizomycetes, indicating that reproduction was produced wholly by fissions, and they were classified as follows: (1) Schizomycetes, cleft fungi. (2) Hypomycetes, mould fungi. (3) Saccharomycetes.

It was also believed that they lived without chlorophyle; but both of these views are found to be at least partially incorrect.

Bacteria are round or cylindrical cells, composed of a cell wall, cell substance, and probably a nucleus. The cell wall is a firm membrane, composed of plant cellulose.

Inside the wall the contents are found to be protoplasm, either granular or homogeneous in nature, and containing chlorophyle, sulphur, pigment, etc.

The outer layer of the cell membrane may absorb moisture and *becomes gelatinous,* by means of which the cell may be enclosed, or there may be formed a chain or grouped arrangement of the cells, due to the adhesive nature of the covering.

Bacteria are developed from pre-existing bacteria or spores; they cannot arise de novo, nor can one bacteria produce cells of a different type.

They are reproduced by means of fission as well as by a process of fruition, while those confining themselves to the latter method are further sub-divided into the anthrosporous and endosporous cells.

In the formation by fission, the process is similar to ordinary cell formation. The cell is divided into two distinct portions, which subsequently separate and may continue to exist independent of each other, or they may remain united.

In the thread forms, which are composed of rod-like cells joined together, the individual cells may be discerned under favorable conditions, such as the application of certain reagents, etc., while in cocci, existing singly or arranged in chains, the cells are distinct.

In *anthrosporous* formation, only a few cells among many are capable of reproduction. These few cells derive their reproductive materials and nutrition from the surrounding cells, which are of themselves incapable of reproduction.

In *endogenous* formation, the germ develops *within the mother cell*, growing at the expense of its own material, and finally the cell wall ruptures, when the newly-formed cell, which is capable of reproduction, is liberated. In order that reproduction may be easily accomplished there must be present, in proper proportions, oxygen, nitrogen, carbon, mineral salts, and a normal temperature or slightly elevated temperature.

Bacteria have been further divided as follows:

(1.) Those bacteria which grow in the air, *erobic.*

(2.) Those which exist without air, *anerobic.*

True anerobins exist without oxygen.

Faculative erobins are capable of existence without oxygen, but develop much better in the presence of oxygen.

Obligata erobins exist only in the presence of oxygen.

Erobins may absorb the oxygen of a part, and thus render the growth of anerobins possible.

There can be no doubt but that many bacteria are incapable of motion, yet there are other forms which may be perpetually endowed with the power of locomotion, while others are so endowed only at certain periods of their existence.

The growth of bacteria is arrested by exposure to the sunlight or electricity.

Bacteria may cause chemical changes, as oxidation, while in parts infected elements are eliminated or withdrawn.

Further, many bacteria have the power of ferments; thus fermentation may be caused as a direct result of the action of the vegetable organism.

An advanced process of fermentation occurs associated with the development of offensive gases, leading to decomposition.

This is called *putrefaction*, and in organic structures is caused by the presence of bacteria.

Many infectious diseases or conditions may be caused by bacteria; such are called *pathogenic bacteria*, while those which do not lead to pathological processes are termed *non pathogenic bacteria*.

Bacteria apparently have all the functions of higher organizations, *i. e.*, breathing, eating, excreting and multiplying, and as their life advances they lose their strength and perish.

SAPROPHYTES are bacteria which exist upon the dead remains of organic life, and develop at a low temperature.

PARASITES are bacteria which exist upon living bodies, and naturally require a normal temperature for existence.

PTOMAINES.—A group of complex alkaloids, similar to those found in ordinary plants, but found in putrefactive conditions.

They have been termed *cadaveric alkaloids*, but the name now includes all basic alkaloids and bodies formed by bacteria, and which affect the body by the production of toxic elements which they produce.

The products *toxin* and *toxalbumen* can be isolated, and are found to consist of two classes: the one, *toxin*, is destroyed by heat, while the other, *antitoxin*, prevents further infection, when present, by its action upon the tissues.

Thus, proteids or toxalbumens extracted from cultures are amorphous and have no basic action, and resemble ptomaines in producing symptoms resembling those produced by bacteria.

IMMUNITY, or the power of resisting the influences of bacteria, may be the result of various conditions.

Natural Immunity.—A condition by which we find that many persons are never influenced by bacteria, while others are susceptible to any or all forms.

Acquired Immunity.—*Disease immunity*, resulting from previous exposure to disease; for instance, persons having been infected with small-pox are rarely influenced by exposure subsequently.

Artificial Immunity may be produced by inoculation with sterilized cultures.

It has been further demonstrated that certain bacteria are antagonistic to others. Thus antrax may be cured by injections of erysipelatous streptococci.

Climatic Immunity.—Under this heading are included cases which may be illustrated by recalling the influences of certain localities, the peculiarities of which do not affect the native, yet strangers will be universally affected by a residence in this locality.

CLASSIFICATION AND DESCRIPTION.

Non-pathogenic bacteria, being rather foreign to our subject, will be omitted, and simply pathogenic bacteria will be considered from a pathological standpoint.

BACILLUS TUBERCULOSIS.—This bacillus was described by Koch in 1882 as occurring associated with tuberculous processes.

The bacillus occurs as straight or slightly curved slender rods, about one-half the diameter of a red blood corpuscle in length. Having rounded extremities and usually occurring singly, though sometimes found in groups, forming acute angles or forms resembling a letter S. They do not possess the power of motion.

For cultivation it requires a special media, and does not grow upon gelatin.

They are of a faculative anerobic nature, develop slowly, and reach their zenith at about three weeks.

Infection is caused by inhalation of the bacilli, which may be circulating in the air, being blown about by the wind, which dries and carries the sputum expectorated by tuberculous patients.

Immunity has been attempted, but as yet the processes seem to be unsuccessful.

BACILLUS ANTHRACIS.—Attention was directed toward this subject in 1850, by Rayer and Davaine, but later the Bacillus was given prominence through the investigations of Pasteur and

Koch. It occurs in the blood of animals suffering with anthrax, and is seen in rods of various lengths, and containing spores, having cupped extremities, and is about twice as large as the bacillus tuberculosis.

The bacillus may be introduced into the system through inhalation, leading to pneumonia, and the infection may be local, as seen in wool-sorters, cattle drovers, herders, etc., in whom a small wound in the hand becomes infected, which leads to gangrene and necrosis.

Immunity may be established through inoculation of sterilized cultures or with cultures of other bacteria.

SYPHILIS BACILLUS.—This bacillus was developed by Lustgarten in 1885, as occurring in the secretion of syphilitic ulcers, in syphilitic tissues and possibly in the smegma of the prepuce and vulva.

They resemble the bacillus of tuberculosis in appearence, save that the ends may be enlarged and that apparent spores may be present.

LEPRA BACILLUS.—Hausen called attention in 1880 to this form, which occurs in rods, similar to, but shorter than those of tuberculosis. They are immobile and contain oval spores.

BACILLUS OF DIPHTHERIA.—A bacillus found in diphtheria and described by Löffler in 1884. They occur as straight or slightly curved rods, of about the same length as the tuberculosis rod, but about twice as broad, and having enlarged ends. The mode of infection and development is not known.

BACILLUS OF TYPHOID.—This bacillus was cultivated in 1884 by Gaffky, but was described by Eberth in 1880 as occurring in the spleen and lymphatic gland. They occur as rods about one-third as wide as long, having rounded ends, flagella on the side, usually occurring long and mobile.

Infection is effected in a susceptible person by the drinking of water or milk, and which have become infected with the dejecta of a diseased person.

BACTERIA OF PNEUMONIA.—Krebs, in 1875, described a bacteria occurring in pneumonia, and later, in 1882, Friedlander developed a bacillus from a case of pneumonia, which he called a pneumococcus. In 1884 Frankel described a microbe, which he called sputum-septicemia micrococcus. This, which has been called "Diplococcus Pneumonia" by Weichselbaum, has been found in many portions of the body.

The Pneumo-Bacillus.—Pneumococcus described by Friedlander

(1882), occurs in the lungs in cases of croupous pneumonia. They occur as small oval-shaped bodies, usually found in pairs and are immobile. In some cases they are found surrounded by a capsule.

The **Pneumo-Bacillus** of Frankel and Weichselbaum was described by them as occurring in the sputum of pneumonic patients. They are somewhat oval, and yet so long that they ordinarily appear rod-shaped, occurring in pairs and immobile.

SPIRILLUM CHOLERA.—Comma bacillus of cholera is described by Koch in 1883 as occurring in the intestines of cholera patients. The bacillus is slightly curved when single, and forms spirals when in groups. The bacillus is about one-half the size of the tubercle bacillus and has a flagella at each end. They have the power of motion, but are markedly affected by either heat or cold. The bacilli are usually introduced into the system by means of drinking water or food, or the introduction in any manner of the bacillus to the mouth or alimentary canal.

BACILLUS NEAPOLITANUS.—A bacillus described by Emmerich as occurring in the intestinal discharges as well as in the blood of cholera patients; but later developments have proven that it is simply the feces bacillus (Brieger), which is seen in the feces of healthy persons, as well as in many putrefactive processes.

In appearance they resemble the typhoid bacillus in being short rods, having rounded extremities and containing oval spaces, but are immobile. They grow more rapidly and offer greater resistance to the heat and cold than do the typhoid bacilli. They are of a faculative anerobic nature.

SPIRILLUM FINKLERI.—A bacillus found in the intestinal discharges of a cholera patient by Finkler and Prior in 1884.

In appearance it resembles somewhat the cholera bacillus, but is found in health.

It has the flagella, consequently mobile, and is a little thicker than the cholera microbe.

It develops at the natural temperature, is faculative erobic in nature, and is destroyed by water.

SPIRILLUM TYROGENUM.—A spirillum described by Dembe in 1885, as occurring in old cheese and resembling the spirillum of cholera.

HEMATOZOA OF MALARIA.—Protozoa which are found in the blood of malarious persons.

The organisms are of various shapes, and may be intracorpuscular or extracorpuscular.

The **Intracorpuscular** bodies are divided into—

(*a*) Unpigmented ameboid, occupying about one-third of the red corpuscle.

(*b*) Pigmented and ameboid. These may be present singly or in numbers; they are pigmented, the source of which is probably the hemoglobin.

(*c*) In the third form the pigment is surrounded by homogeneous bodies, which are constantly changing in shape, or the pigment may be free.

The extracorpuscular varieties are of peculiar form, and are probably derived from the intracorpuscular variety.

(*a*) Laveran's semilunar bodies. These occur as motionless or free crescent-shaped bodies, in which, in the serum, are seen small and movable particles of pigment.

(*b*) Those in which fine and granular protoplasm form rosettes, but the arrangement is destroyed and the pigment liberated with the termination of a paroxysm.

(*c*) Those of an oval form, having flagella about the size of a red corpuscle.

SUPPURATION.—Suppuration of wounds, etc., is caused by micro-organisms, among which are:

Streptococcus Pyogenes.—Rosenbach described this form as occurring in all cases of suppuration, occurring singly or in chain-groups, and immobile. In man these bodies are found in cerebro-spinal meningitis, yellow fever, variola and scarlatina.

In erysipelas, it is found in the lymphatic glands. They may occur on the valves of the heart and endocarditis result.

When invading the endometrium, puerperal fever may result.

Streptococcus Pyogenes Aureus.—These microbes were described by Rosenbach as occurring in a large proportion of cases of suppuration. They are also found in sputum of healthy subjects and forming a reddish-yellow pigment. They occur as micrococci in grape-like bunches (never forming chains) and immobile.

Micrococci Pyogenes Albus.—Described by Rosenbach as resembling the pyogenes, save that there is no pigmentation.

Micrococcus Gonorrhœa.—Described by Neisser, in about 1879, as occurring in cases of specific urethritis, being present as cocci, occurring in packs, immobile and resembling Vienna rolls, to which appearance the Germans applied the name lemmel.

Infection in man is easily produced, and may cause specific inflammations in parts infected, as the eye, etc.

Gonococci may be distinguished from the following similar micrococci, occurring in the vagina or urethra, by not growing in gelatine and by being found in the protoplasm of the cell.

Micrococcus Citreus Conglomeratus resemble the gonococci, and is found in the gonorrhœal pus and in the air.

Diplococcus Albicans Amplus and Tardissimus.—Both forms have been described by Bumm, the former occurring in vaginal secretions, resembling the gonococcus, but larger.

The latter occur in urethral pus, resemble the gonococcus and are not movable.

Micrococcus Subflavus, also described by Bumm as occurring in discharges from the vagina and urethra in health. They resemble the gonococcus and are not movable.

TRUE FUNGI, (Yeast and Moulds.)—A few of these may be mentioned, as being of a pathogenic nature.

Yeasts, (Saccharomycetes,) are propagated by budding, the spores being attached to the mother-cell.

Saccharomycetes Cervisiæ (Torrula Cervisiæ).—Beer yeast, of which there are several varieties, which impart various flavors to the beer.

Oidium.—This is a mixture of moulds and yeasts, sometimes one and sometimes another, or both may be seen in one culture.

Oidium Lactis occurs in sour milk and butter.

Oidium Albicans, (Thrush Fungus,) occurs upon the mucous membranes of the mouth. They resemble yeasts and are abundantly found, occurring as spores and filaments in the white patches lining the cavity of the mouth.

MOULDS.—The **Penicillum glaucum** is the more common and occurs wherever moulds are present, but does not play an important part in pathology.

Tricophyton Tonsurans.—Described, in 1854, by Bozin in Tuila. They resemble the oidium lactis, but develop more quickly.

Pathologically.—Herpes tonsurans and tinea are caused by this fungus.

Achorion Schonleinii was described by Schoenlein, in 1839, as occurring in all forms of favus; they are found in the crusts and resemble somewhat the above fungi.

Pathologically, it causes favus.

Microsporon Furfur resembles the above and is found upon the skins of persons suffering with wasting conditions.

Pathologically, it causes tinea versicolor.

HEUPPE'S CLASSIFICATION.

(*c.*) COCCI (Round or Oval Cells).

Streptococcus.—Arranged in chains; zooglea moderate, spores endogenous.

Arthrostreptococcus. — Arranged in chains; zooglea very marked, spores or anthrospores unknown.

Merista.—Arranged in fours, with small chains.

Sarcina.—Arranged in eights or fours, without small chains.

Micrococcus.—Zooglea intermingled; arranged in masses.

Ascococcus.—Zooglea in encapsulated and spherical masses.

(*b.*) CELLS (Cylindrical Rods).

Long or short threads, without distinction of apex or base threads, flexible or rigid.

Arthrobacterium.—Threads wavy or straight, no endogenous spores.

Spirulina.—Threads wavy, straight or spiral, mobile; no endogenous spores.

Bacillus.—Threads wavy or straight, formations of endogenous spores without change of cells.

Clostridium.—Same as above, save that there is a change of the cells and that the rods become spindle-shaped.

Threads with a distinction of apex and base.

Leptothrix.—Threads without sheaths, no divisions, without presence of sulphur.

Beggiota.—Resembles above, save that the sulphur is present.

Clodothrix.—Threads with sheath, divisions and branched.

Crenothrix.—Threads with sheath, divisions and unbranched.

(*c.*) **SPIRAL OR CURVED RODS.**

Spiral.—Threads rigid and flexible.

Spirillum.—Endogenous spores without change of form.

Vibrio.—Endogenous spores with change of form.

Spirocheta.—Fructification and formation of anthrospores, unknown.

FUNGUS—ITS CLASSIFICATION AND OCCURRENCE. (Cohn.)

(*a.*) **YEASTS, (Saccharomycetes.)**

Torula Cervisiæ.—Common yeast.

(*b.*) **MOULDS, (Hypomycetes.)**

Pencillium Glaucum.—Simple mucoid fungus.

Oidium Albicans.—Causes thrush.

Aspergillus Glaucus.—Causes diseases of external ear.

Achorion Schonleinii.—Causes favus.

Tricophyton Tonsurans.—Cause tinea tonsurans.

Microsporon Furfur.—Causes pityriasis.

Mucor Mucedo.—Causes madura.

Actinomycosis.—Causes actinomycosis.

Ustilago Corbo.—Causes the formation of Ergot on rye.

(*c.*) **CLEFT FUNGI, (Schyzomycetes.)**

Microbus Bacteria.

Microbacteria.—Fermentation bacteria, occurring as dumb-bell-shaped or short rods, and giving rise to digestive, acetic, butyric, lactic and purtrefactive ferments.

Desmobacteria. (long rods.)—This class is said to be the cause of typhoid fever, syphilis, tuberculosis, lupus, leprosy, anthrax, glanders, pearl disease and hog cholera.

Those who believe in the microbic origin of cancer and sarcoma associate the conditions with this form of bacteria.

Spirobacteria (spirals.)—Under this heading we find the bacteria of cholera (Koch's comma baccillus), cholera morbus, cholera infantum, and relapsing fever.

The vibrio varieties cause dysenteries.

Spherobacteria (globules.), also called monads, cocci, asococci and staphylococci. In masses, *zooglea;* pairs, *diplococci;* fours, *merista;* eights, *sarcina;* chains, *streptococci.* These forms are supposed to be the cause of acute atrophies, fatty degenerations, etc.; mumps, goitre, scarlatina, rubeola, variola, erysipelas, gonorrhœa, diphtheria, pneumonia, ulcerative endocarditis, typhus and yellow fever, septicemia and pyemia.

According to De Bary's classification, the bacteria are divided into two groups, *endosporous* and *anthrosporous*.

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